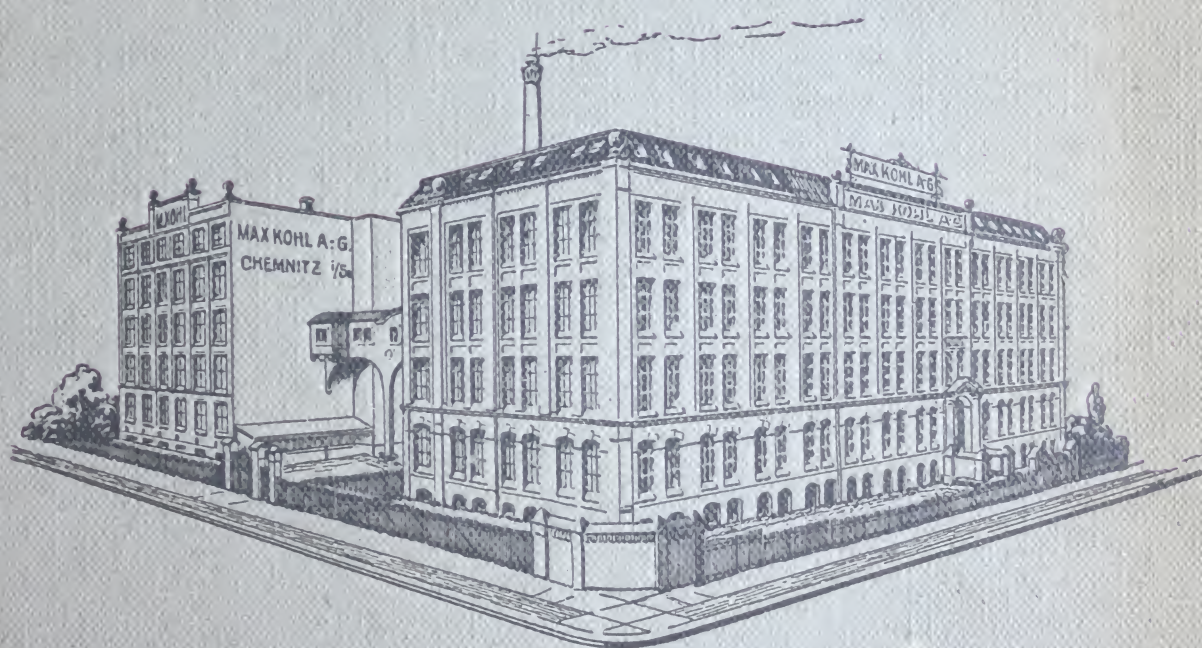


MAX KOHL A.G.

Chemnitz (Germany.)

Price List No. 50, Vol. IV.



Physical Apparatus.

Price-Corrections of the Price List No. 50, Volume IV.

Educational and Laboratory Furniture, Physical Apparatus.

Page	List-No.	Objects	New Price £ s. d.	Page	List-No.	Objects	New Price £ s. d.
1307	50001	Lecture Table (as suggested by Weinhold), 3 m long	24. 0.0	1315	50282	Wall Cupboard	20. 0.0
"	50002	do. 3.5 " "	25.10.0	"	50283	do.	16. 0.0
"	50003	do. 4 " "	28. 5.0	"	82092	Chemical Cupboard	9. 4.0
"	50004	do. 4.5 " "	30. 5.0	"	82093	Iron Wall Cupboard	18. 5.0
"	50005	do. 5 " "	32.15.0	"	82094	Iron Museum Cupboard (standing alone)	77.10.0
1308	50050	Chemical Lecture Table, 3 m long	27. 5.0	1336	82250	Three Phase-Direct Current Transformers with Starter and Shunt Regulator	26.10.0
"	50051	do. 3.5 " "	32. 0.0	"	82251	do.	30. 0.0
"	50052	do. 4 " "	33. 6.0	"	82252	do.	34. 0.0
"	50053	do. 4.5 " "	35.10.0	"	82253	do.	36.10.0
"	50054	do. 5 " "	38. 7.0	"	82254	do.	41.10.0
1309	50046	Simple Lecture Table for Secondary and Continuation Schools		"	82255	do.	46. 5.0
"		2.5 m long	14. 5.0	1343	54029a	Direct-Vision Prisms after Koenigsberger	2. 2.0
"	50047	do. 3 " "	15. 7.0	"	54030	do.	2.15.0
"	50048	do. 3.5 " "	18.15.0	"	54031	do.	4.16.0
"	50049	do. 4 " "	22.15.0	1347	82310	Stand for the Half-watt Projector Lamp	0.18.0
"	82089	Lecture Table	18. 5.0	"	82311	do.	0.18.6
1310	82090	Students' Work Table with Table Substructure	41. 0.0	1391	82583	Hipp's Chronoscope	24.15.0
"	50291	Students' Work Table with Cupboard Substructure	19. 7.0	"	82584	do.	18.15.0
1312	50303	Iron Stink Cupboard with one Compartment	17.16.0	"	82585	Demonstration Chronoscope	27. 5.0
"	50304	do.	19. 7.0	"	82586	Jaquet's Recording Chronometer	5. 8.0
"	50305	do.	22. 6.0	1413	52189	Prandtl's Apparatus	6.18.5
"	50306	do. with a number of compartments		1426	53171	Wave Machine after Steindel	15. 0.0
"		a) 23. 3.0 b) 28.15.0		1437	82815	Spherical Photometer 50 cm	42.10.0
"	50307	do. a) 27. 5.0 b) 32.15.0		"	82816	do. 100 "	64. 0.0
"	50308	do. a) 32. 0.0 b) 41. 0.0		"	82817	do. 150 "	78. 0.0
"	50309	do. a) 36.10.0 b) 50. 0.0		"	82818	do. 200 "	99. 0.0
1313	50297	Stink Cupboard with Cupboard Substructure	11.10.0	1439	53632	Carrying Case is to be cancelled.	
"	82091	do.	18. 5.0	1442	53818	Goniometer and Spectroscope	2.15.0
1315	50280	Glass Cupboard (standing alone)	29.10.0	1480	83058	Wolff's Colorimeter	6. 6.0
"	50281	do.	23.10.0	1485	83076	Apparatus for Compressing Carbonic Acid and other Gases	41. 0.0

Corrigenda.

Page 1489, Figure 83080, not 83080a.

Page 1489, Figure 83081, not 83080b.

The prices of the catalogue

No. 50 vol. IV

are subject to **70 %** increase as well as these of

catalogue No. 50 vol. I, II and III.

The prices of Laboratory furniture in the catalogue are not valid. The valid prices are quoted in the Correction-Table on the inner page of the cover, they are also subject to **70 %** increase.

Please take notice of the other corrections of prices.

Chemnitz, November 1925.

Max Kohl, Aktiengesellschaft.

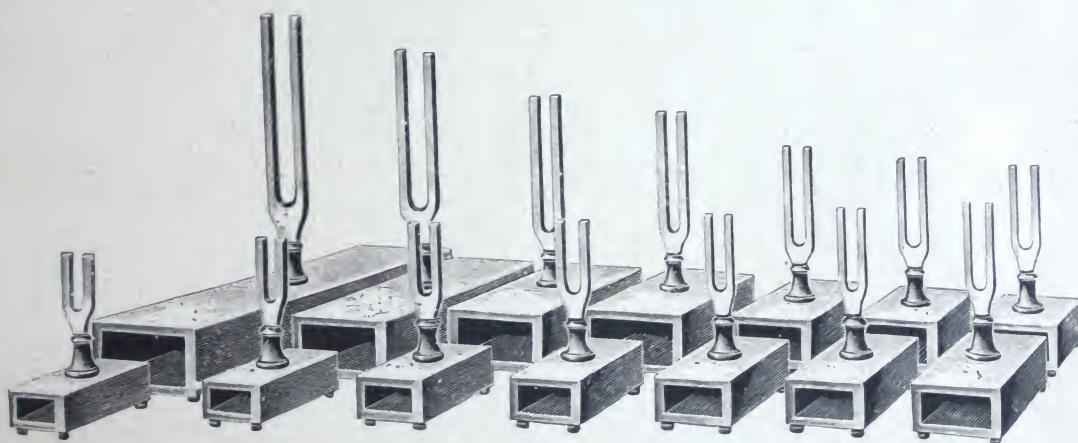


Price List No. 50, Volume IV.

Educational and Laboratory Furniture.

Physical Apparatus

for Mechanics, Wave Theory, Acoustics,
Optics, Heat, Meteorology and
Cosmology.



Tuning Forks on Resonance Boxes.

MAX KOHL A. G.

CHEMNITZ i. S.

Adorfer Strasse 20.

Telegraphic Address: Physics.

ABC-Code 5th Ed. used.

Telephones: _____

Nos. 3104, 3105, 3106.

Capital, fully paid up: 2 Million Marks.

Terms of Sale.

Delivery is assumed to be taken and payment made at Chemnitz, and all disputes shall be referred to the Tribunal there.

All prices quoted in this catalogue are strictly nett cash, without discount.

We reserve the right, in the case of orders not submitted by German Authorities or German State or Municipal Educational Institutes, to ask for payment with order, or before despatch of the goods, or to request cash on delivery, unless we have had opportunity of sufficiently ascertaining the ability of the purchaser to pay for them.

Times of delivery are where possible stated and adhered to, although these are not binding; and we cannot assume any liability for the consequences of any delay that may arise. For orders received from abroad, we should be given any special instructions necessary as regards shipping, customs clearance, etc.

Complaints about shortages will only be considered if submitted immediately on receipt of the goods.

All orders are despatched for account and at the risk of the consignee.

All packing is carefully carried out by skilled packers, and we can assume no liability for breakages occurring in transit. In order to protect our customers from loss due to breakages, we insure consignments against breakage and loss in transit, charging the lowest possible premium.

Cases and packing, unless otherwise arranged, are charged separately. Cases and packing material are credited to two-thirds the invoiced value if returned to us free and in good condition. The prices for packing quoted against certain articles in the catalogue are for ordinary inland packing only. Overseas packing is generally 100 per cent. more. Unless other instructions are received, we pack overseas consignments in cases lined with zinc or oiled cloth, but consignments overseas to European ports are sent in ordinary cases unless overseas packing is specially asked for.

The illustrations shown in the catalogue do not correspond in every detail with the apparatus supplied, as we reserve the right to make modifications and improvements to apparatus.

In the case of many pieces of apparatus, auxiliary apparatus, etc. are also illustrated in order to show how a given instrument is used. These extras are not included in the price and are only supplied if specially ordered and paid for.

The scale mentioned below the illustrations is only intended to give an approximate idea of the size of the apparatus, and does not bind us as regards the size of the apparatus. In perspective drawings, this scale usually applies to only one dimension.

With many articles, we have shown nett and gross weights. All weights quoted are, however, only approximate, and not binding. Overseas packing usually weighs 50 per cent. more than ordinary land packing.

Max Kohl,
Aktiengesellschaft.



Preface.

Volumes II. and III. of our Price List No. 50, shown above on a much reduced scale, were sent originally to all institutes and educational establishments giving instruction in physics. We hope that the list is still available; but if not, we shall be glad to send a fresh copy, on application, to those who are genuinely interested in receiving it.

The present Vol. IV. of the principal price list No. 50, which deals with educational furniture and physical apparatus, completes the list. Since we produced our Catalogue No. 50 we have included a fairly large number of apparatus of new design in our manufacturing programme. Of these and of many other pieces of apparatus we have had fresh illustrations made to facilitate selection.

We hold an extremely large stock of physical apparatus, being thus able to satisfy heavy demands in a short time. Our modern and scientific works equipment also enables us to undertake the equipment of class-rooms and laboratories and the supply of physical apparatus with the minimum of delay.

In conclusion, any further confidence that our customers will kindly show us in future will be repaid by punctual and careful execution of all orders with which we may be favoured.

Max Kohl,
Aktiengesellschaft.

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Literature

with details of Abbreviations.

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Gan.-Man.	Ganot-Maneuvier, Traité élémentaire de physique, 23rd Edn., Paris 1905, Hachette & Cie.
Gan.-Atk.	Ganot-Atkinson-Reinold, Elementary Treatise on Physics, experimental and applied. Longmans, Green & Co.
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—	Kleiber, Joh., Lehrbuch der Physik für humanistische Gymnasien, 3rd Edn., Munich and Berlin, 1904.
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M. P.	Müller-Pouillet-Pfaundler, Lehrbuch der Physik und Meteorologie. 10th Edn. 1906–09, Vol. I. II ¹ , II ² , III, IV ¹ . Brunswick 1902–1908, Friedrich Vieweg und Sohn.
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	Zeitschrift für Psychologie und Physiologie der Sinnesorgane.
	Zeitschrift für Instrumentenkunde.
Z. d. V. d. I.	Zeitschrift des Vereins deutscher Ingenieure, Berlin.

A Few Unsolicited Testimonials Recarding Kohl's Physical Apparatus, etc.

Leipzig (Fockestr. 25), 5th April, 1925.

I should like to say, in addition, that the apparatus arrived safely and is perfectly satisfactory.

Hugo Moß, Studienrat,
Trade School, Scharnhorststr.

Liegnitz (Schlesien), Martinstr. 35, 31st March, 1925.

The optical bench has arrived and I am glad to inform you that we are extremely satisfied with it.

Stud.-Rat Michael.
Städt. Gymnasium und Realgymnasium.

Lvov, 27th March, 1925.

As head of the school physics section, I had the opportunity before the war of judging of the excellent quality of your products. As the school is now adequately provided with funds, I should like to order several pieces of apparatus from you.

Vincenz Podlacha, Gymn. Professor,
Assistant in the Physics Section of the
University, Dlugosza ul. 8.

Pernau (Esthonia), 18th March, 1925.

Referring to the apparatus supplied in 1923, this has worked very satisfactorily up to now.

H. Kosenkranius, Head Teacher
of Physics at the Gymnasium.

Rotterdam, 18th March, 1925.

I have to inform you of the safe arrival of your consignment of physical instruments as per your invoice of 28th February. This I find entirely satisfactory.

Jac. Couzij.

Biedenkopf, 7th March, 1925.

As we have previously obtained our supplies from you and found them satisfactory, we will certainly purchase further supplies from you.

Studienrat Appel,
Realgymnasium.

Achim, 6th March, 1924.

The apparatus has arrived safe and sound. Extremely satisfied.

Göhre, Studienrat.
Achim School.

Heiligenbeil (Ostpreußen), 5th March, 1925.

I am glad to say that your consignment of 25th February has come to hand safely, and I am very satisfied with the way in which it is constructed.

Studienrat Erdmann.
School of Agriculture.

Falkenburg (Pommern), 17th February, 1925.

My experience with you in the purchase of physical apparatus has been very satisfactory.

Higher School Director Schwalm,
Schiller-Mittelschule.

Güstrow, 17th February, 1925.

Referring to the visit of your director, Mr. Reichel, last September, I am very glad to say that the experiment table No. 59042 supplied by you last August has been found to be extremely satisfactory in every respect. The table gives a pleasing appearance of work well carried out. The material used, such as wood, leads, shutters, etc., is highly satisfactory. The whole construction of the table proves that the firm who made it have had very wide experience in this class of work.

L. Dahnke, Rector,
Boys' School.

Welzheim, 9th February, 1925.

The ammeter ordered has arrived safely, and I am highly satisfied both with its nice appearance and faultless construction.

Seiler, Realschule.

Echternach, 7th February, 1925.

All the apparatus has arrived in good condition, and I can assure you I am extremely pleased with it.

Prof. Dr. Nicolas Kuffer,
Großherz. Gymnasium.

Halle (Saale), 7th February, 1925.

The A. C. transformer and the triple pole switch have meantime come to hand and have met with entire satisfaction.

Handwerkerschule.

Weltevreden (Java), 3rd February 1925.

I am glad to have this opportunity of informing you that I am highly satisfied with the excellent construction of the apparatus sent. Every piece has arrived without having suffered the slightest damage. Packing was also very carefully carried out.

W. Haaxman, Engineer.

M.-Ostrau, 3rd February, 1925.

I have pleasure in acknowledging receipt of the demonstration moving coil galvanometer I ordered. Thanks to having been thoroughly well packed, it arrived in perfect condition. I am extremely satisfied with the apparatus; the construction and finish being of a high order.

Prof. Eugen Hoffmann,
Girls' School.

Wolgast, 31st January, 1925.

All apparatus hitherto supplied by you I have found extremely satisfactory.

Studienrat H. Nimmerjahn.

Quebec (Canada), 29th January, 1925.

I am satisfied with the physical apparatus which I received from your house in July, 1923.

Brother Mactalius,
St. Patrick's School.

Kobe (Japan), 12th January, 1925.

Your physical apparatus have been purchased from time to time through importers at home, and we have the pleasure to say that they have been found always satisfactory.

The Kobe Koto Shosen Gakko.
(Kobe Higher Mercantile Marine School.)

Straubing, 6th January, 1925.

We have to inform you that the induction coil ordered has arrived safely and we find it perfectly satisfactory.

The Ursuline Teachers' College.

Lausanne, 18th December, 1924.

I have to inform you that the apparatus you sent have arrived safely. Everything was in order, and I thank you.

Raph. Cordone,
Collège scientifique.

Pola, Italy, 17th December, 1924.

Many years ago, when I was a professor at the Gimnasio reale here, I ordered several pieces of apparatus from you and found them entirely satisfactory.

A. Gregoretti,
R. Scuola Complementare.

Instertburg, 16th December, 1924.

As we have now received your latest price list, we will place our order from this. We are the more induced to do this as we are very greatly satisfied with the equipment of the physics room and with your apparatus.

Lauruschat.

Karlsbad, 5th December, 1924.

Our directors are glad to testify of their own accord that all the equipment and supplies received from you arrived in perfect condition, and give proof of very neat and accurate workmanship.

Staatsfachschnle für Porzellanindustrie,
Administration.

Leipzig, 26th November, 1924.

I have to acknowledge receipt of the tuning forks with resonance boxes, etc. which you supplied to me on 24th November. The consignment reached me in perfect condition, and I am extremely satisfied with the resolution of the resonance boxes that you suggested and with the tone of the forks.

Many thanks for your kindness in this matter.

Dr. med. F. Kleinknecht.
Privatdozent and Assistant at the Physiological
Dept. of the University.

Anklam, 17th November, 1924.

We acknowledge receipt of the projection apparatus. We are highly satisfied with the fine workmanship of it.

Studienrat Franz Grube,
Gymnasium.

Soria (Spain), 12th November, 1924.

I have received your letter of the 20th October, and also, with some delay, your parcel containing catalogue No. 50 (Vols. II. and III.), which far exceeds anything of the kind published by us or the French.

I am much obliged to you for sending it and will study it carefully.

Eugenio Ortega,
Professor, Ecole Normale, Soria.

San Paulo, 12th November, 1924.

I have pleasure in thanking you very much, for this consignment has reached me in perfect condition.

As regards the finish of the apparatus, it is just what I expected from your excellent reputation.

Essen, 9th November, 1924.

The apparatus you recently supplied to the Essen-Altstadt Boys' Higher School has arrived safely and to our satisfaction.

C. Elfers, Master.

Schönheide (Erzg), 6th November, 1924.

In the course of a conversation with the head of the school here, he spoke in high terms of your firm as regards the supply of physics and chemistry apparatus.

Armin Stopp,
Bookseller.

St.-Gilles-Brussels, 2nd November, 1924.

I have here a number of pieces of your apparatus, with which I am very satisfied.

Fr. Marcellin,
Institut St.-B. de la Salle.

Hammerstein, 28th October, 1924.

I notice that I obtained a few things from you in 1920, and I am perfectly satisfied with them.

Sill, Rector.

Gernsbach (Baden), 23rd October, 1924.

The consignment has turned out to our entire satisfaction.

Prof. Emil Michenfelder,
Realschule Gernsbach i. Murgtod.

Johannisburg (Ostpreußen), 23rd October, 1924.

... About 1920 I purchased some apparatus from you, and am glad to say it is excellent.

Dr. Rubach,
Realgymnasium.

Garacal (Rumania), 20th October, 1924.

I have purchased from you a 15 Volt 2 Amp. dynamo, with which I am perfectly satisfied.

Constantin Predeteauen,
Prof. of the State Gymnasium.

Brussels, 20th October, 1924.

I am happy to associate myself with the numerous expressions of appreciation you have received, and to say that your apparatus has always given me entire satisfaction.

Victor de Bruyn, Professor of Physics,
Institut St.-Joseph, Rue d'Assaut, 18.

Shanghai, 27th September, 1924.

We have meantime safely received your partial consignment, which has given our customer every satisfaction.

Medicon Limited.

Lausanne, 25th September, 1924.

Further, I am very happy to tell you that I am satisfied with your apparatus, which has arrived in good condition.

Raph. Cordone, Prof.
College et Gymnase scientifique.

Bayreuth, 24th September, 1924.

I can certainly assure you that we are all highly satisfied with the sound workmanship and astonishing range of uses to which your experiment table can be put. The convenient arrangement of the cupboards and the quality of the glassware are also very satisfactory.

Gewerbe-Hauptlehrer E. Höppel,
Municipal Trade Continuation School, Bayreuth.

Cieszyn (Poland), 23rd September, 1924.

I am afraid I am rather dilatory in writing in the name of the directors of the two Elementary Schools here, to state that we are perfectly satisfied with the physical apparatus and educational auxiliaries supplied by you. Packing was very carefully carried out, so that nothing suffered damage in transit.

Jan Sikora,
nancz. szkoly. wydz. zenskiej.

Güstrow (Meklenburg), 23rd September, 1924.

The experiment table gives the impression of sound and neat workmanship.

L. Dahnke, Rector.
Boys' School.

Flensburg (Neumarkt 10), 20th September, 1924.

The apparatus arrived yesterday and proved satisfactory.

A. Jürgensen.

Militzsch (Bezirk Dresden), 9th September, 1924.

In 1919 I purchased a 3 metre experiment table from you for the Lyzeum Laurahütte, and this has proved extremely satisfactory.

Dr. C. Jaschke,
Rectorate of the Municipal Secondary School.

Hersfeld, 27th August, 1924.

The apparatus you sent me came to hand yesterday, and I am very well satisfied with it.

L. Fuß, Teacher.

Bahia Blanca (Argentina), 20th August, 1924.

I am highly satisfied to find that various pieces of apparatus are working normally.

R. Grustin,
Prof. of Physics at the College Don Bosco.

Dublin, 18th August, 1924.

I beg to say that the Weiss magnet recently supplied is quite satisfactory.

T. H. Mason.

Turin, 13th June, 1924.

Per incarico del Professore addetto al Gabinetto di Fisica vi comunico che il materiale tutto è arrivato in ottime condizioni et ha riposto bene alla prova.

(At the request of the Physics Professor, I have to inform you that all the material arrived in perfect condition, and has proved satisfactory on trial.)

Accademia Militare d'Art. Genio.

Leiden (Holland), 11th June, 1924.

In conclusion, we are able to state that we have always been satisfied with your supplies.

W. Einhorn,
Physiologisch Laboratorium der Rijks-Universiteit.

Dresden, 2nd June, 1924.

As we are so satisfied with apparatus previously obtained from you, we would like to make further purchases from you.

Dr. Freytag,
Oberrealschule Dresden-Seevorstadt.

Apparecida do Norte Est. San Paulo (Brazil),
25th April, 1924.

Since I have had the apparatus here, scarcely a day passes without a visit from some outside professor. All highly admire your products.

P. Paulo Forster,
Prof. of Mathematics, Missionary Seminary.

Ahrensböck near Lübeck, 8th May, 1924.

I am satisfied with the equipment you supplied to the Real Gymnasium at Oldenburg.

V. Siemer, Studienassessor.
Realschule Ahrensböck.

Krako (Yugoslavia), 4th May, 1924.

I am very satisfied with your delivery of chemical apparatus. Especially pleasing are the practical shape and the size of the instruments.

Jos. Zabkar, Teacher.

Ortelsburg, 3rd May, 1924.

For further supplies of Physical Apparatus we shall consider your firm alone, as we have been greatly satisfied with your apparatus.

Studienrat Knorre,
Reform-Realgymnasium.

Neustadt (Oberschlesien), 28th March, 1924.

In acknowledging receipt of the apparatus supplied I have pleasure in expressing my entire satisfaction at its faultless construction.

Studienrat Felka,
Staatliches Gymnasium.

Husum, 27th March, 1924.

In the summer of 1923 we obtained from you a Hartl's disc and an electroscope, with which we are perfectly satisfied.

Dr. Bästlein, Lyceum.

Vel. Kikinda, 23rd February, 1924.

The accumulators supplied are exactly what I wanted, as they work very well.

Prof. Kutalinic,
Physik. Kabinett des Staatsgymnasiums.

Welzheim, 9th February, 1924.

The instruments supplied have arrived in good condition and work excellently. I thank you very much for prompt and satisfactory delivery.

Prof. Seiler, Realschule.

Shanghai (China), 4th January, 1924.

The goods supplied have met with my entire satisfaction and I have with pleasure referred some schools to you which consulted me in regard to the purchase of Physical Apparatus.

Prof. Dr. Jos. Drexler,
Tung-Chi-University.

Turin, 29th April, 1924.

We are glad to inform you that the material was duly received in perfect order and has proved satisfactory.

Accademia de Militare d'Art. e Genio.

Chicago U. S. A., 6th April, 1924.

The large Photometer bench arrived here on the 2nd April. The size and nice construction surpass all my expectations. All pieces arrived without damage. Your delivery will be a good advertisement for your firm.

Phil. W. Froebes, Loyala University,
Loyala, Avenue and Sheridan Road.

Potsdam N. Y., U. S. A., 4th April, 1924.

We have some of your apparatus, which are of excellent workmanship.

Fred. F. Piper,
Prof. of Physics, Clarkson College.

Kew, Melbourne (Australia) 2nd March, 1924.

The different instruments I have obtained from you I have found to be very satisfactory and would willingly get others from you.

Xavier College.

Segovia (Spain), 26th March, 1924.

We have received your consignment as per your invoice and are greatly satisfied with the contents.

Academia de Artilleria.

Patras (Greece), 4th November, 1923.

Having been very satisfied with a collection of Physical Apparatus obtained from you some years ago for the Gymnase de la Canée (Isle of Crete) I address myself to you and beg you etc.

Dr. P. Christopoulos,
Président de l'Union des professeurs,
Gymnase de Patras.

São Paulo (Brazil), 14th September, 1923.

This apparatus was received in perfect order and has proved very satisfactory (Foucault's pendulum No. 52017).

Irmao Epiphany, Prof. de Ciencias
Gymnasio de N. S. do Carmo.

Segovia (Spain), 8th October, 1923.

Being engaged at the chemical laboratory as successor to Mr. Enrique Montesinos who called my attention to the very sound workmanship of the lecture table supplied by you, I beg you etc.

Gaspar Regelado,
Principal Master at the Academia de Artilleria.

Fiume, 7th October, 1923.

All items arrived without damage and are constructed most excellently. I express my entire satisfaction with them.

Dr. S. Gigante,
Liceo Gymnasio „Dante Alighieri“.

Schönebeck, 30th August, 1923.

I acknowledge with thanks receipt of the Wehnelt interrupter, which has given entire satisfaction.

Dr. Schönebeck, Reform-Realgymnasium.

Neustadt (Oberschlesien), 29th August, 1923.

The apparatus recently supplied have met with my entire satisfaction.

Studienrat Felka, Staatsgymnasium.

Rathenow, 23rd August, 1923.

The fume cupboard supplied by you has met with approval on all sides. The beauty and practicability of it excite our admiration

Dr. Gärtner, Realgymnasium.

Funchal (Madeira), 25th July, 1923.

I am in receipt of your consignment of the 12th May, which has proved very satisfactory.

Liceu de Jaime Moniz.

Rathenow, 7th August, 1923.

The apparatus ordered some time ago have all arrived and are satisfactory in every way. We thank you very much for the way in which the order was executed, and trust we shall be able to order many other apparatus from your firm in future.

Studienrat M. Hauschild.
Realgymnasium.

Conegliano, 17th March, 1923.

I am highly pleased with the apparatus supplied, and find the design improved in many ways.

R. Scuola di Viticoltura e di Enologia.

Cracow, 23rd March, 1923.

I beg to inform you that all apparatus were duly received in perfect order. I wish to thank you for the way in which you have carried out the order, and will gladly consider you in the case of future orders.

Otto Nykodym, Gymnasiallehrer
und Leiter des phys. Kabinett im
IX. Staatsgymnasium.

Wilhering near Linz, 12th March, 1924.

The very fine and accurate construction of the apparatus supplied by you leads me to inquire etc.

P. Paulus Kitzmüller, Prof. und Kustos
des phys. Kabinetts des Gymnasiums der Zisterzienser.

Heidelberg, 22nd February, 1924.

The instruments, supplied by you have — as far as I have been able to ascertain up to now — arrived in perfect order. I beg herewith to express my thanks for the careful manner in which you executed all my previous orders.

Dr. Kurt Hofmann-Degen,
Oberrealschule.

Maxglan (Salzburg), 12th January, 1923.

The induction coil was duly received in perfect order and works excellently.

The appearance and essentially practical character of the apparatus evoke our admiration.

Ignaz Oberndorfer, Religionslehrer.
Realgymnasium.

Betzdorf-Kirchen, 5th January, 1923.

I should like to express my entire satisfaction at your having supplied all apparatus so quickly and in such an excellent manner.

Prof. Dinckelacker, Realgymnasium.

Funchal, 28th November, 1923.

Your consignment of the 7th October has already arrived. I am greatly satisfied with it. The zoological preparations are faultless and the physical apparatus were very well packed.

Liceu de Jaime Moniz.

Eisenach, 1st December, 1922.

The Looser's Thermoscope with accessories was duly received and has proved very satisfactory.

Dr. K. Feldrappe, Ernst-Albert-Schule.

Luxembourg, 14th November, 1922.

In spring 1915 you supplied through us to the Vereinigte Hüttenwerke Burchbach-Eich-Düldingen in Dommeldingen (Institut Emile Metz) Window Darkeners which have proved very satisfactory.

L. & V. Mersch & Co.

Souhindol (Bulgaria), 3rd November, 1922.

We have always been highly satisfied with your apparatus.

Direktion Realschule.

Lörrach, 3rd November, 1922.

We are highly pleased with your apparatus and feel that they will also be durable. Thank you very much.

Direktion
der Volks- und Mädchen-Bürgerschule.

Sao Paulo, 8th October, 1922.

I have just received all items specified in your different letters. All are satisfactory in every way and confirm the excellent opinion I have of your firm.

M. Irmao Epiphanyo,
Gymnasio de N. S. do Carmo.

Dresden, 2nd October, 1922.

I am very pleased to inform you that, at the inauguration of our institute, the equipments supplied by you met with approval on all sides and all visitors noted with interest the name of the manufacturer.

M. Bergmann,
Kaiser-Wilhelm-Institut für Lederforschung.

Lörrach, 19th September, 1922.

The apparatus arrived here on the 19th September. We are highly pleased with it and have to express our most sincere thanks for the careful manner in which our order has been carried out.

Rektorat der Mädchenbürgerschule.

Lörrach, 28th August, 1922.

The electroscope surpasses all our expectations, as it indicates the voltage of a net-work without condenser. The Papin's digester is also very nicely made.

Professor Crecelius, Realschule.

Neustadt (Oberschlesien), 22nd June, 1922.

I take this opportunity of expressing to you our entire satisfaction in regard to the faultless execution of the projection apparatus, the switch-boards, and the other apparatus.

Studienrat Prof. Neus, Staatl. Gymnasium.

Montreal, Rue St. Denis 288, 30th May, 1922.

In 1911 we bought from you a great number of physical apparatus with which we have been greatly satisfied.

Adolphe Dollo,
Prof. à l'École Polytechnique.

Funchal (Madeira), 19th May, 1924.

I just received the apparatus specified in your invoice of the 24th March. I am glad to inform you that my impressions as to the material are the best, everything seems to be of excellent quality. I hope that in using the apparatus I shall find confirmed my impressions and thank you for your efficient and prompt execution.

Liceu de Jaime Moniz.

Knechtsteden, 20th May, 1924.

Having been a teacher of Physics at our Mission Broich near Aachen for more than 3 years, I feel it a pleasure to certify that I have always been highly pleased with the apparatus obtained from you and I feel sure that such will be the case this time.

P. H. Maas,
Missionshaus Knechtsteden.

Jassy, 1st April, 1924.

We received the apparatus ordered through Mr. Mathes and have found it to be of first-class quality.

D. M. Cosmonici.
Laboratoire de Physiologie Comparée
à l'Université.

Jassy, 28th April, 1922.

We should like to advise you that the laboratory equipments ordered through Mr. Matthes for the Mineralogical Laboratory of the University of Jassy have been received in perfect order and that we are highly pleased with them.

Prof. V. C. Butureanu,
Laboratorul de Mineralogie si Petrografie,
Universitatea.

Welzheim, 6th May, 1922.

I have now received all the apparatus ordered from you. After having examined it, I feel I must express my most sincere thanks for the careful manner in which this order has been effected. In my opinion, it is hardly possible to construct the apparatus in a more instructive and durable manner. It is a constant source of joy to experiment with this excellent apparatus.

Should we again be in a position to buy apparatus, I shall certainly deal with no other firm and I shall recommend you among my professional colleagues.

P. Seiler, Realschule.

Savignano di Romagna, 2nd May, 1922.

After having carefully tried all apparatus, I am glad to express to you my satisfaction with them in regard to their beauty and precision.

Il Direttore, Scuola Tecnica.

Brussels, 3rd May, 1922.

The commission charged with the receipt of the material has expressed its entire satisfaction in regard to the excellent and accurate construction of the apparatus supplied by you.

Le Colonel d'Etat-Major de Camp honoraire
du Roi Commandant.

Pola, 18th June, 1922.

I am very pleased to inform you that the physical apparatus bought from you at different times always work with ease and certainty.

Prof. Bruno Grignaschi,
Ginnasio Liceo Carducio.

Caracas, 13th March, 1922.

On the 2nd inst. I received the 2 cases No. 8048/49 containing apparatus ordered on the 29th July. These have arrived in excellent condition, and contents have met with my customer's entire satisfaction. My customer and myself wish to thank you for the careful execution of the order.

Victor M. Alvarez,
Principal Santa Capilla No. 5.

Rochester (N. J.), 23rd February, 1922.

I beg to state that this material arrived in excellent condition. I wish to thank you for your attention to our order, and will hope that in the near future we shall again have cause to use your products.

Eastman School of Music.

Worms, 6th March, 1922.

We bought a similar pump from you in August 1920 with which we are greatly satisfied up to now.

Klöter & Lawall.

Breslau, 16th February, 1924.

The projection apparatus, the heliostat and the blowing table which you supplied are of first-class quality and I am glad to have ordered them from you.

Dr. Gerlich, Studienrat,
Oberrealschule.

Fürstenwalde (Spree), 24th February, 1924.

For many years we have been using your oil vacuum pumps, with which we have obtained very satisfactory results.

Julius Pintsch A.-G.

Breslau, 28th February, 1922.

All equipments supplied by you meet with our entire satisfaction.

Direktor Dr. Fritz Hofmann,
Kohlenforschungs-Institut.

Tilsit, 5th February, 1922.

The experiment table arrived here in excellent condition and has met with our entire satisfaction.

Charlotte Neiss, Stud.-Ass.,
Städtisches Lyceum.

Freiburg (Baden), 9th February, 1922.

The gravitation balance has arrived in good condition and works very well.

F. Himstedt, Phys. Institut der Universität.

Goldap, 29th January, 1922.

As far as I have examined the apparatus I have found them to be excellent.

Klein, Lehrer der städtischen Mädchenschule.

Calcutta, 29th December, 1922.

We have just completed the tasting of the apparatus you sent us lately and hasten to convey to you our approval of the same.

A. Briot, S. J. St. Xavier's College.

Welzheim, 21st January, 1922.

I acknowledge receipt of your consignment as per invoice of the 6th January, 1922. The goods arrived here in excellent condition. The apparatus is remarkably beautiful and constructed with a high degree of accuracy. I was delighted when I unpacked it. I shall be glad to get the other apparatus soon so that I shall be able to examine all together.

P. Seiler, Realschule.

Langenberg (Rheinland), 21st January, 1922.

The vacuum pump bought from you 1913/14 still works quite as well as it did in the first year.

Fischer, Stud.-Dir., Lyceum.

São Paulo, 12th November, 1922.

I feel it my duty to express my entire satisfaction especially in regard to packing. Not the slightest damage has been caused in transit. The apparatus seem to be of excellent quality, just as I expected them to be from your firm.

Irmao Epiphanio,
Professor de Physica & Chem.
Gymnasio do Carmo.

Brux, 2nd December, 1921.

As I am very satisfied with apparatus obtained from you formerly, I now wish to buy similar apparatus.

Prof. Karl Müller.

Oldenburg, 15th November, 1921.

The physical installation supplied by you for the Realgymnasium in this town (Auditorium, preparatory room, museum, students' work rooms) is — like that previously supplied for the Oberrealschule Eisleben — entirely satisfactory. It has met with everyone's approval.

Prof. Dr. Franz Willers,
Reform-Realgymnasium.

Bandoeng (India), 16th September, 1921.

The 6 cases containing Physical apparatus have safely reached us. I am highly pleased with them.

Prof. Dr. Clay, Director of the Laboratory
of the Technical College.

Landshtut, 21st September, 1921.

We beg to acknowledge receipt of your consignments of August and September and have pleasure in expressing our most sincere thanks for the careful manner in which this order has been executed.

Max Sigg,
Lehrer an der Schule St. Nikola.

Montevideo, 18th May, 1921.

Your consignment was duly received in perfect order. We beg to express our entire satisfaction with it.

Finsterwald & Schaich.

Bukarest, 4th April, 1921.

Your consignment has arrived in good condition and has met with our entire satisfaction.

D. E. Ludwig,
Ministerne Instructione „Casa Scoalelor“.

Freiberg, 23rd April, 1921.

The thermostat ordered reached us safely and has given complete satisfaction.

Dr. E. Krüger.

Habana, 17th de February, 1921.

I am satisfied with the quality of the material and the fine condition in which it arrived.

J. Salaverri, S. J.,
Colegio de Belen.

Haarlem, 6th March, 1921.

In 1913 your firm supplied to the Superior Commercial School a lot of physical apparatus which have proved very satisfactory.

Dr. G. de Vries,
Höhere Handelsschule.

Pivitsheide, 24th January, 1921.

The second induction coil repaired by you arrived also without damage. It works excellently. I thank you very much.

Lütchemeier, Lehrer.

Hamburg, 18th January, 1921.

We are glad to inform you that our overseas customers are highly pleased with the apparatus. The packing was also satisfactory.

Schlubach, Thiemer & Co.

Funchal (Madeira), 14th December, 1920.

I am glad to express my entire satisfaction in regard to the material, and thank you very much.

Liceu de Jaime Moniz.

Gais, 1st December, 1920.

I am quite satisfied with the apparatus supplied by you and will therefore place further orders with you when we require fresh equipments.

Reallehrer Amman, Landesrealschule.

Santander, 19th November, 1920.

After having unpacked the apparatus, I am able to state that I am quite satisfied with the workmanship and with the care with which they were packed.

P. Ignazio Acebo, Colegio Cantabro.

Flensburg, 15th November, 1920.

You supplied the complete equipment of the State Gymnasium and Realgymnasium in Flensburg. All items supplied have met with our entire satisfaction.

Professor Iwers, Gymnasium.

Nürnberg, 12th October, 1920.

The laboratory equipments and the laboratory basins were duly received. Everything is very satisfactory.

Dr. Hils & Dr. Eble.

Zürich, 11th August, 1920.

As I am greatly satisfied with your March delivery, I feel I ought to tell you so. The large induction coil works very well indeed and evokes general admiration.

Peter Früh.

Zürich, 7th July, 1920.

The electro-magnet after Prof. Weiss has safely arrived here. Its workmanship has met with our entire satisfaction, I thank you very much for careful delivery.

Prof. Dr. Edgar Meyer,
Physik. Institut der Universität.

Fyrabad (India), 4th June, 1920.

Your reputation previous to the war in the line of scientific instruments was world-wide.

R. Bhattacha,
Eg. Bsc. LL. B., Head Master Hindu High School.

München NW 2, 4th July, 1920.

In 1902 a Cavendish apparatus for attraction of masses No. 52144 was ordered, at my suggestion for the Physics Dept here. The apparatus worked very well when I showed it in my lectures. I now write to inquire

Prof. Dr. Karl T. Fischer,
Physik. Lehrmittelsammlung d. Techn. Hochschule.

Zehlendorf, 8th June, 1920.

Your consignment arrived in good condition. I am very satisfied with the apparatus supplied.

Dr. Kaiser, Oberlehrer,
Oberrealschule mit Reformrealgymnasium.

Bartenstein, 10th May, 1920.

Your consignment was duly received and has met with our entire satisfaction.

Dr. Oberlehrer Mollenhauer,
Königin Sophie-Charlotte-Schule (Städt. Lyceum).

Degersheim, 1st May, 1920.

I am delighted with the fine workmanship of the apparatus, while from the standpoint of design, they leave nothing to be desired. Should I ever be in need of physical apparatus, I shall gladly come to you.

Hans Früh, Physiker.

Aachen, 21st April, 1920.

Your second consignment like the first, meets with my fullest satisfaction.

A. Monmartz, Collegium Josephinum.

Godesberg, 28th April, 1920.

I bought from you in December lost several rotating oil vacuum pumps, with which I am exceedingly satisfied.

Firma Dr. Aug. Nefgen.

Kolberg, 19th April, 1920.

I have now tried the last piece of apparatus and am glad to express to you my fullest approbation. I further have to thank you for having so generously considered my wishes.

P. Raduß, Mittelschullehrer, Knabenmittelschule.

Neustadt (Oberschlesien), 8th March, 1920.

All items have safely arrived and have, as usual, given full satisfaction.

Studienrat Neus,
Staatliches Gymnasium.

The Hague, 25th February, 1920.

During this year we shall again be in want of physical apparatus, and shall gladly bear your firm in mind.

Ambachtsschool.

References to Equipment, Apparatus, Instruments, etc.

supplied to Physics, Biology and other Laboratories
of following Institutions and Firms:

- Aachen**-Rothe Erde, Hüttengesellschaft der Rothen Erden, Zweigniederlassung der Luxemburgischen A.-G.
- Adlershof** (near Berlin), Aircraft Establishment.
- Allahabad** (India), Education Society.
- Adorf i. V.**, Claviez A.-G., Textile Works and Artificial Weaving Looms.
- Amsterdam**, Lycée.
Gymnasium,
Oberrealschule.
- Annaberg**, Realgymnasium.
- Asch** (Czechoslovakia), Staatsgymnasium.
- Aschaffenburg**, A.-G. für Zellstoff- und Papierfabrikation.
- Aschersleben**, Reformgymnasium.
- Arnhem** (Holland), N. V. Nederlandse Kunstseidfabrik.
- Athens** (Greece), Ecole supérieure d'Agriculture.
- Arnsberg i. W.**, Armei Schulschwestern of U. L. F.
- Aue i. E.**, Girls' Secondary School.
- Auerbach i. V.**, Higher Elementary School.
- Auerhammer i. E.**, Dr. Geitners Argentanfabrik, F. A. Lange.
- Augsburg**, Realgymnasium,
Trades Hall,
Maschinenfabrik Augsburg-Nürnberg.
- Bad Berka i. Th.**, Waldpädagogium Dr. W. Hallbauer.
- Bad Oeynhausen**, Luisenschule.
- Bad Villingen**, Schwarzwald Brass Works.
- Barby a. d. E.**, Seminary.
- Bayreuth**, Trade Continuation School.
- Belgrade**, Marko W. Georgevitch & Brother.
- Berlin**, Bergmanns Elektrizitäts-Werke A.-G.,
Main Ambulance-Depot,
Vereinigte Fabriken für Laboratoriums-Bedarf, G. m. b. H.,
Oberrealschule,
Deutsche Erdöl A.-G.,
Kursächsische Braunkohlen Gas und Kraft G. m. b. H.,
Central Institution for Education in Natural Science,
Elizabetschule,
General Assay Lab. at the School of Mines,
Dr. Georg Hennig, Chemical and Pharmaceutical Works.
- Berlin-Dahlem**, Gertraudenschule.
-Friedrichsfelde, Realgymnasium,
Girls' Higher School.
-Johannisthal, A. E. G. Flugzeugbau.
-Lichterfelde, Dipl.-Ing. Harry Pauling,
-Mariendorf, Elementary School.
- Berlin-Marienfeld**, Fritz Werner A.-G.,
Engineering Works.
-Niederschönhausen, Reform-Gymnasium,
Realgymnasium.
-Schmargendorf, Realgymnasium.
-Schoedeberg, High School for Girls.
-Steglitz, Lycée.
-Tempelhof, Lycée.
-Wilmerdorf, Reform-Realgymnasium.
- Bieberach**, Teachers' Training College.
- Bischofswerda**, Seminary.
- Bitterfeld**, Griesheim-Elektron Chemical Works.
- Bochum**, Boys' Higher Grade School.
- Bologna**, Dr. Zimmermann.
- Breda** (Holland), J. J. van Tornhout.
- Bremen**, Teachers' Training College.
- Breslau**, Fritz v. Friedlaender-Fuld, Coal Research Institute,
Silesian Coal Research Institute.
- Bruchsal**, Oberrealschule.
- Bruenn**, (Czechoslovakia) Chemical Dept. of Technical College.
- Budapest**, Pathological Institute.
- Budweis** (Czechoslovakia), Trade School of Metal Work.
- Cassel**, Frauenbildungsverein,
Arth. Müller, Land- und Industriebauten A.-G., Abtg. Ponderfwerk Cassel,
Maschinenbau.
- Celle**, Gymnasium.
- Charlottenburg**, Municipal Laboratory,
Preparation Laboratory and Maschine Dept. of Technical College,
Metallurgical Dept. of Technical College,
Electrotechnical Dept. of Technical College,
Electrochemistry Dept. of Technical College,
Inorganic Chemistry Dept. of Technical College.
- Chemnitz**, Küchwald Infirmary,
Meat Inspection Dept.,
Trade and Continuation School,
Technical State Teaching Dept.,
Dye School of above,
Pathological Institute,
Professional School,
Commercial College,
Franz Niescher, Margarine Works,
H. Th. Böhme A.-G., Chemical Works,
Rud. Otto Habermann,
H. Dygnowity, A.-G.,
Pöge Electricity Co.,
C. G. Haubold, A.-G.,
Bruno Sieler, Weaving Works,
"Afaq" Wireless Construction Co.
- Chur**, (Switzerland) Secondary and Commercial College.
- Clausthal**, Lycée.
- Cloppenburg** (Oldenburg), Realprogymnasium.
- Coblenz**, Hilda School.
- Copenhagen**, Dansk Farveri und Mercisierungsanstalt, Hasselbach & Co.
- Cöpenick**, Gas Works.
- Colmar** (Alsace), Lycée
- Coswig** (Dresden), Carl Tiedemann,
Lacquer & Paint Mfr.
- Cottbus**, Oberrealschule,
Boys' Intermediate School.
- Crefeld-Rheinhafen**, W. & H. Melsbach,
Soap Works.
- Crossen**, Leonhardt Söhne.
- Cuxhaven**, Marine School.
- Darmstadt**, E. Merck, Chemical Works,
Eberhardt & Metzger Nachf.
- Dervent** (Bosnia), Realgymnasium.
- Dessau**, Chemical Research Bureau,
Bacteriological Institute.
- Doebeln**, Körnerplatz School.
- Dordrecht**, Naamlooze Vennootschap Stikstofbindungsindustrie "Nederland".
- Dresden**, Zoological Dept. of Technical College,
Chemical Dept. of Technical College,
Training School of the Druggists' Union,
Ica, A.-G.,
Carl Wiegand,
Deutsche Trinidad-Asphalt Co.,
Meiser & Mertig, G. m. b. H.,
Kaiser-Wilhelm Institute for Leather Research.
- Dresden-Leubnitz**, Dr. Volkmar Klopfer,
-Uebigau, Funkerkaserne.
- Düsseldorf**, Children's Clinic,
Ströhlein & Co., Laboratory Suppliers,
Kurt Retsch, Laboratory Suppliers.
- Duisburg**, Duisburg Cable Works.
- Dux** (Czechoslovakia), Realgymnasium.
- Eibenstock** (Sachsen), Trade School.
- Eilenburg**, Dermatoid Works,
Paul Meissner.
- Elsterberg i. V.**, Spinnfaser- und Kunstseidenspinnerei A.-G.
- Emden**, Marine School.
- Engelsdorf** (near Leipzig), Board School.
- Erlangen**, Chemistry Dept. of University.
- Essen**, Rex, Mineralölgesellschaft,
Stefan Bock & Ziegler.
- Essen-Bredene**, Realgymnasium.
- Fiume**, Oberrealschule,
Civica scuola reale superiore.
- Flensburg**, Gymnasium,
Realgymnasium,
Oberrealschule No. II.
- Forst** (Lausitz), Reform-Realgymnasium,
Realschule.

Frankenberg (Sachsen), School for Junior Officers.
Frankfurt (am Main), University, Infirmary, J. G. Mouson & Co.
Fraulautern (Saar), G. Meguin, Ltd., Oil Works.
Freiberg (Sachsen), Mineralogical and Geological Institute of the University.
Freiburg (Breisgau), Botanical Dept. of University.
Freital (Sachsen), Martin Uhlemann, Chemisches Laboratorium.
Friedrichsfelde - Karlshorst, Realgymnasium.
Fürstenwalde (Spree), Teachers' Training College.
Füssen (Lech), Schreiner-Zwangsinning.
Gardelegen, Realgymnasium, County Sanitorium.
Geneva, Pathological Dept. of University.
Gleiwitz, Girls' School.
Glückstadt (Holstein), Peter Temming, Cotton Bleaching Wks.
Goldap, Realgymnasium.
Greifswald, Physics Dept. of the University.
Greiz, Girls' Intermediate School.
Grevesmühlen (Mecklenburg), Reform-realgymnasium.
Griesheim (Main), Griesheim - Elektron Chemical Wks.
Großdubran (Sachsen), H. Schomburg & Sons, A.-G., Margarethenhütte.
Groß-Strehlitz, Teachers' Training College.
Groß-Wusterlitz, Feuerwerks-Laboratorium bei Plaue (Havel).
Grünberg (Schlesien), Gymnasium.
Güstrow, Board School.
Gütersloh (Westfalen), Teachers' Training College.
Havana (Cuba), Colegio de Belen.
Hagen (Westfalen), Akkumulatoren-Fabrik.
Haifa, Technical Institute.
Hainichen (Sachsen), Technical Institute.
Halle (Saale), Oberrealschule, Physiology Dept. of University.
Halsen, A. Riebeck'sche Montanwerke, A.-G., Werchen und Weissenfelder Braunkohlen A.-G., Elektrotechnisches Institut G. m. b. H.
Hamburg, Leopold Unger & Co.
Hamm, Catholic Seminary.
Hannover, Dr. R. Haase, Siemens & Halske, Technical Dept.
Heilsberg (Ostpreußen), Realschule.
Helsingfors (Finland), Lycée.
Hertens (Finland), Keskusliike Osakeyhtiö.
Herten (Westfalen), Rektoratschule.
Hirschberg (Saale), Hirschberg Leather Works.
Hirschberg (Schlesien), Oberrealschule.
Hofgeismar, Progymnasium.
Hohensalza, Women Teachers' Training College.
Houston (Texas), William Rice Institute, Physics Dept.
Jena, Oberrealschule, Mineralogical Dept. of the University, Physics " " " " Hygienics " " " "

Jena, Dental Clinic, School of Optics, Carl Zeiss, Ltd.
Ilseburg (Harz), Ilseburg Copper Works.
Ihringshausen (near Kassel), A.-G. für Optik und Mechanik.
Judenburg, Steierische Gußstahlwerke, A.-G.
Kappeln (Schlei), Staatliche Aufbauklasse.
Karlsbad, Porcelain Industry State School.
Karlsruhe, Gymnasium.
Kattowitz, Fürstliche Pless'sche Bergwerks-Direktion.
Kiel, Pathological Dept. of the University, Surgical Clinic " " " "
Kieff, Physico-Chemical Society.
Kirchmöser, Pulverfabrik b. Plaue (Havel).
Klotzsche, Board School.
Köln, Dr. Janke & Kunkel.
Königsberg (Preußen), Realschule, Hufen Lycée, State Lycée with Students' Annexe.
Köslin, Gymnasium.
Kolberg, Lycée and Advanced Lycée.
Kovno (Lithuania), German "Oberrealschule".
Kraukau (Cracow), Nerve Clinic.
Kriebstein (Sachsen), Kübler & Niethammer, Paper Works.
Kruppamühle (Oberschlesien), Oberschlesische A.-G. für Fabrikation von Lignose, Army and Navy Guncotton Works.
Krappitz (Oder), Oberschlesische Zellstoffwerke, A.-G.
Landsberg (Warthe), Lycée.
Landshut (Bayern), Zimmer-Werk, Chemical Factory.
Langenberg (Rheinland), Girls' Higher Grade School.
Lauban (Schlesien), Gymnasium.
Lauenburg (Pommern), Gymnasium.
Lausanne, Ecole de Commerce sous Beaulieu.
Lehe, Lycée.
Leipzig, Oberrealschule, Mineralogical Dept. of the University.
Leisnig, Board School.
Lichtenrade (near Berlin), Reformrealgymnasium.
Lodz (Poland), State Textile School.
Lübeck, Frees Lycée.
Lüneburg, Teachers' Training College.
Lugau, Gewerkschaft „Gottes Segen“.
Luxemburg, Physics Laboratory of the "Athenaeum", Limbertsberg School of Industry, L. & V. Merch & Co.
Lwow (Poland), Institut Chemiczny Uniwersytetu Jana Kasimierza.
Lyk (Ostpreußen), Hochbauamt.
Madrid, W. Prado.
Magdeburg, Siemens & Halske, A.-G.
Magdeburg-Sudenburg, Rassbach & Kralle, Lacquer Works.
Mannheim, Hedderheimer Kupferwerk und Süddeutsche Kabelwerke, A.-G., Josef Bossert, Instrument Maker.
Marburg, Elisabethschule, Mineralogy Department of the University.

Marienberg (Sachsen), Realschule, Progymnasium.
Mehlem (Rhein), Ringsdorf, Dynamo Brush Makers.
Menden (Kreis Iserlohn), Realgymnasium.
Meppen, Catholic High Grade School for Girls U. L. Frau.
Merseburg, Badische Anilin- und Sodafabrik, Merseburg Ammonia Works, Leuna Works.
Mittweida (Sachsen), Alinika-Werke.
Mühdorf (Inn), Realschule mit Lateinabteilung.
Mühlheim (Ruhr), Deutsch-Luxemburgische Bergwerks- und Hütten A.-G., Abtg. Friedrich Wilhelmshütte.
Münster, Karl Lemcke, Mechanical Inst. Maker & Optician.
Möser, Powder Factory near Plaue (Havel).
Nagyszeben (Hungary), Franciscans' Women's Training College.
Neubabelsberg, Dr. Graf & Co., Chemical Works.
Neubrandenburg, Girls' Higher Grade School.
Neuhof (near Hamburg), Jul. Schindler, Oil Works.
Neukölln, Industrial Training School, Boys' Secondary School, Private Lycée.
Neurode, Progymnasium, Realschule.
Neustadt (Orla), Berufsschule.
Neustrehlitz, Höhere Knabenschule.
Nijni-Chirskaya (Russia), Alexieff Realschule.
Nortorf (Harz), Secondary School.
Novo-Alexandria, Land and Agricultural Institute.
Nürnberg, Rheinisch-Westfälische Sprengstoff A.-G., Dr. Hils u. Dr. Eble, Technisch-chemisches Untersuchungs-Laboratorium.
Oels (Schlesien), Teachers' Training College.
Offenbach (Main), Girls' School.
Olbersdorf (Sachsen), C.A. Gruschwitz A.-G.
Oldenburg, Realgymnasium.
Oldisleben, Gewerkschaft Großherzog Wilhelm Ernst, Kaliwerk.
Olpe (Westfalen), Teachers' Training College.
Ortelsburg, Teachers' Training College.
Oskarsborg (Norway), Faestings-artilleriets Underofficersskole.
Osnabrück, Realgymnasium, Protestant Boys' School.
Paderborn, Reismann Realschule.
Potsdam, Lycée.
Paris, Henri Hess.
Passau, Lycée.
Peine, Mineralölwerk Peine.
Petersdorf (Riesengeb.), Glanzfäden A.-G.
Pirna, Teachers' Training College.
Plauen (Vogtland), Seminary, Girls' High School, Public School of Commerce.
Posen, Luisenstiftung.
Premnitz (Westhavelland), Vereinigte Köln-Rottweiler Pulverfabriken, Pulverfabrik Premnitz.
Pulsnitz (Sachsen), School.

Quedlinburg, Wilhelm Brauns G. m. b. H.,
Aniline Dye Works.

Radeberg, Fireworks Laboratory.

Rathenow, Realgymnasium.

Ratibor (Oberschlesien), Rütgerswerke
A.-G., Abtg. Planiawerke,
Chemische Werke Carbon G. m. b. H.

Ratingen, Teachers' Training College.

Reichenberg, State School of Industry.

Rössel (Ostproußen), Gymnasium.

Rosario de Santa Fe (Argentine), Facul-
tad de Ciencias Médicas, Instituto
de Fisiología.

Rostock, Chemistry Dept. of the University.

Rotterdam, Gemeentewerken, Allgemeine
Dienst,

N. V. Mascot Export Compagnie.

Ruda (Oberschlesien), Realschule.

Rüstringen, Realgymnasium.

Sagan, Seminary.

Santander (Spain), Collegio Cantabro (Pp.
Augustinos).

Salzwedel, Lighting and Water Works.

Schlettstadt, Women Teachers' Training
College.

Schneeberg (Sachsen), School of Drawing.

Schneidemühl, Gas Works.

Schwarzenberg, Realschule,
School of Commerce and Industry.

Schwerin, Girls' High School.
Gymnasium Fredericianum.

Segovia (Spain), Academia de Artilleria.

Sömmerda, Dreyse & Collenbusch.

Sonderburg (near Flensburg), Women
Teachers' Training College.

Spandau, Gymnasium,
Lycée supérieure.

Sprotten, Realgymnasium.

Stade, Lycée.

Stadel, Stadelers Saatuchtgenossenschaft,
e. G. m. b. H.

Stallupönen, Realprogymnasium.

Staßfurt, Realgymnasium.

Stendal, Boys' Secondary School

Stettin, Schiller-Realgymnasium,
Marienstifts-Gymnasium.

Scharnhorstschule,

Frauenhochschule,

Feldmühle, Papier- und Zellstoffwerke
A.-G.

Stettin - Grabow, Navigation School.

Stockholm, Aktiebolaget P. A. Norstedt
& Söner.

Stuttgart, F. Mollenkopf.

Tangermünde, Girls' School.

Tiflis, Boys' High School (Gymnasium).

Tilsit, Luisenschule,
Lyzeum,
Oberlyzeum.

Tondern, Girls' High School.

Treuen, School of Commerce.

Tübingen, Skin and Ear Clinic.

Uerdingen (Rhein), Chemische Fabrik
vorm. Weiler-ter-Meer.

Ulm, Realgymnasium.

Unna, Winter School of Agriculture.

Urga (Mongolia), Ministry of Popular
Education.

Verden, Teachers' Training College.

Vladivostock, School of Commerce.

Wald (near Solingen), Infirmary.

Waldenburg, Lower Silesian School of
Mines.

Waldheim (Sachsen), Realgymnasium.

Walsrode, Wolff & Co., Pulver- und
Sprengstoffabrik.

Warnemünde, Seeflugzeug-Versuchskom-
mando.

Wartenburg (Ostproußen), High School.

Weissenfels, Oberrealschule.

Weisswasser (Oberlausitz), Osram, G. m.
b. H.

Wernigerode (Harz), Boys' Higher School.

Wesel, Techn. Handelsgesellschaft Wesel
m. b. H.

Wien, Girls' High School (Realgymnasium).

Wiesdorf (Niederrhein), Higher Grade
School.

Wolfen (near Bitterfeld), A.-G. für Anilin-
fabrikation.

Wormerveer (Holland), Jan Dekker.

Würzburg, Zoology Dept. of the University.

Zagreb (Croatia), Board School.

Zittau (Sachsen), Gymnasium.

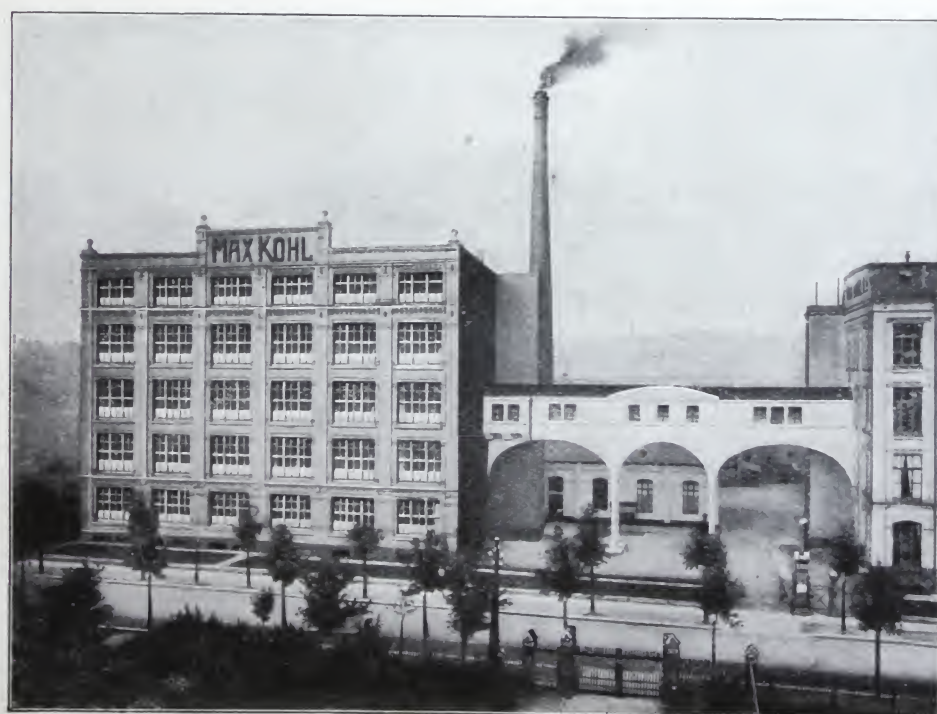
Zwickau, Girls' High School.
Public School of Commerce.

Zuffenhausen (near Stuttgart), Kreidlers
Metall-Drahtwerke. (Wire Works).

Max Kohl, Aktiengesellschaft, Chemnitz



Administration Buildings, Mechanical Workshops and Cabinet Shops



Cabinet Shops

Some Views of our Manufactory.

Max Kohl, Aktiengesellschaft, Chemnitz



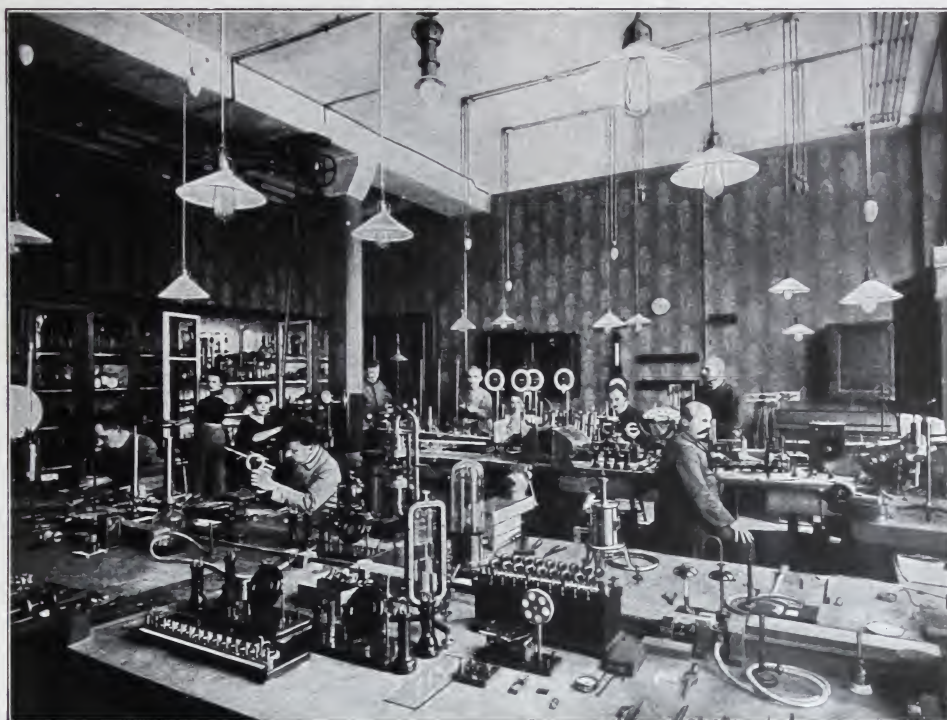
Main Office



Electrical Laboratory

Some Views of our Manufacturing Rooms.

Max Kohl, Aktiengesellschaft, Chemnitz



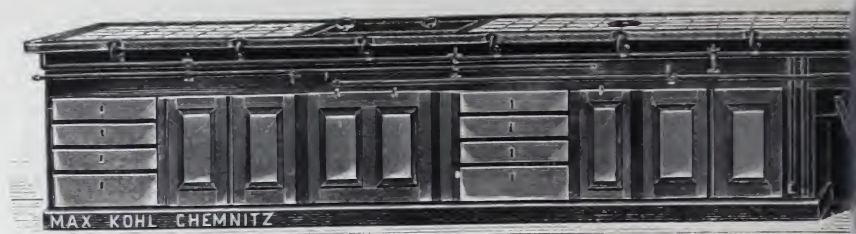
Adjusting-Room



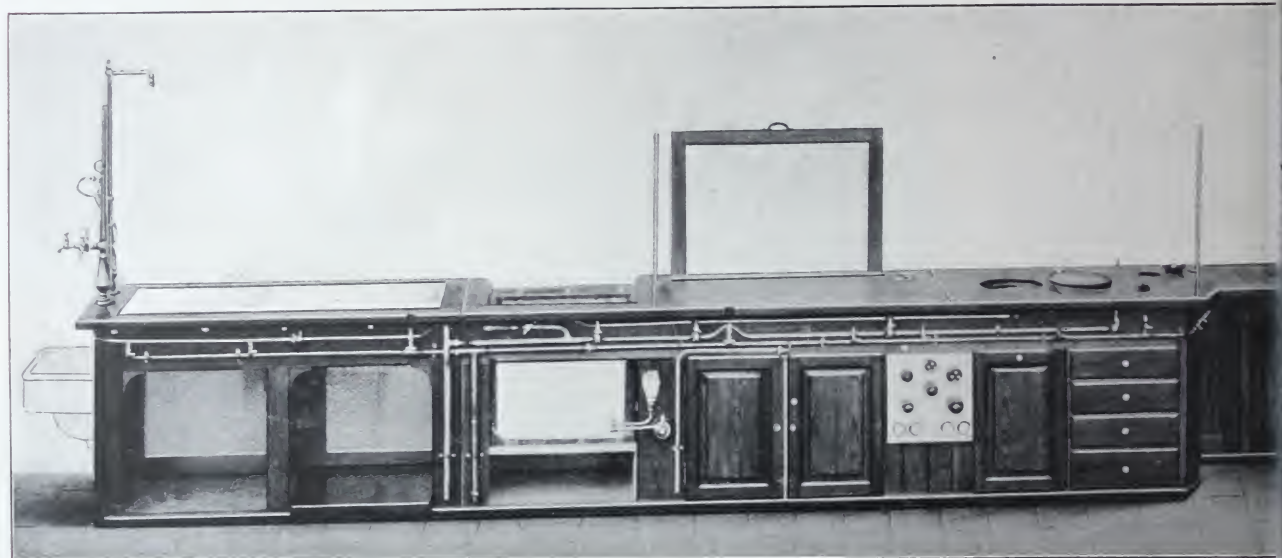
View of one of our Workshops

Some Views of our Manufacturing Rooms.

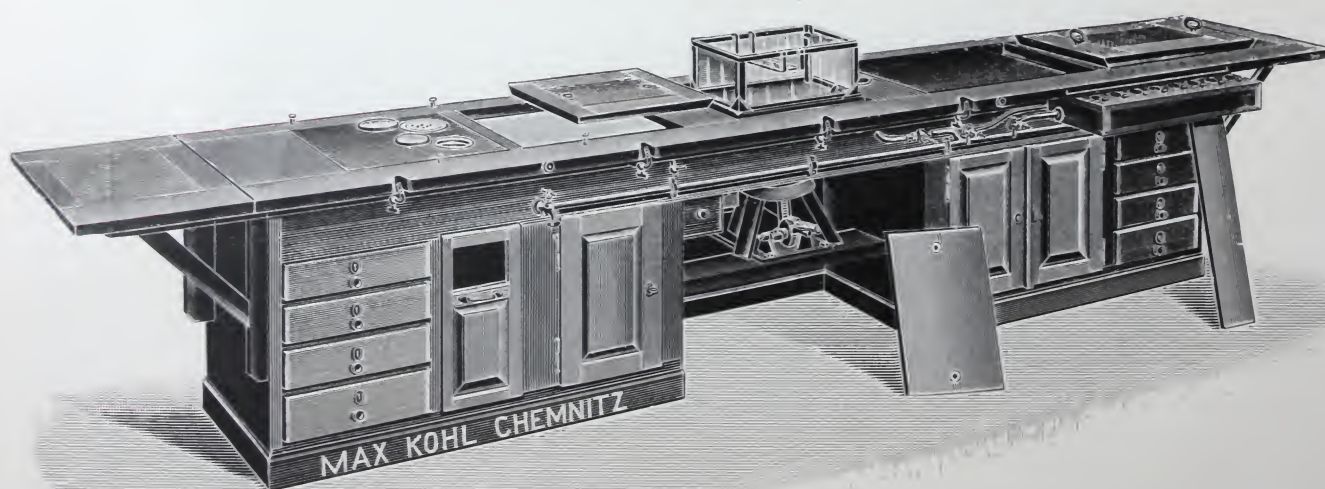
Description and prices of the
figured tables on request.



Lecture Table, in the Cl

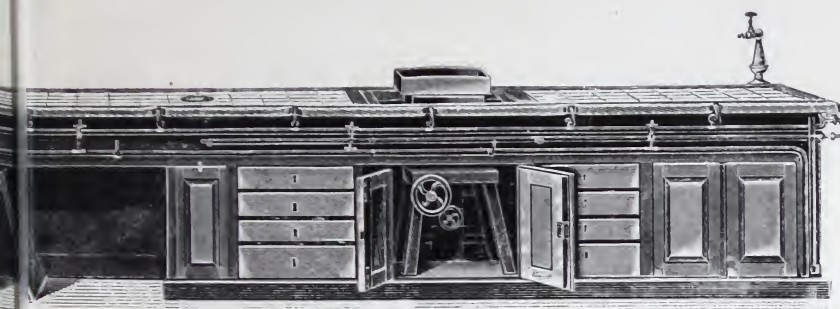


Lecture Table, in the Laboratory for exper



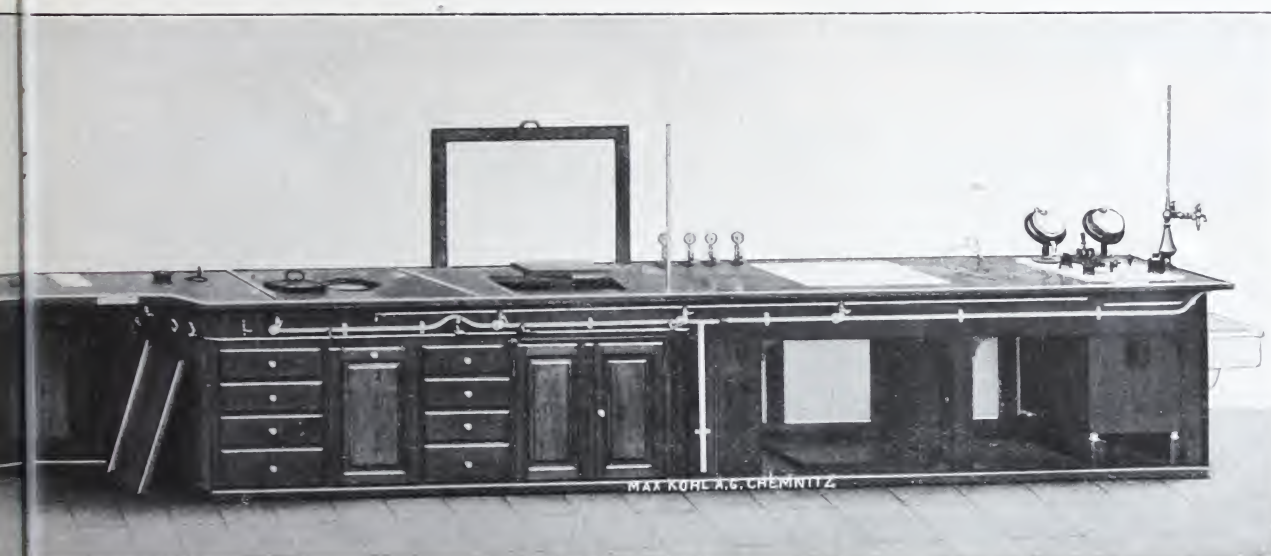
50 003, 50 011, 50 012, 50 019, 50 022, 1 : 23.
Lecture Table (as suggested by Weinhold) with special fittings.

Tables.

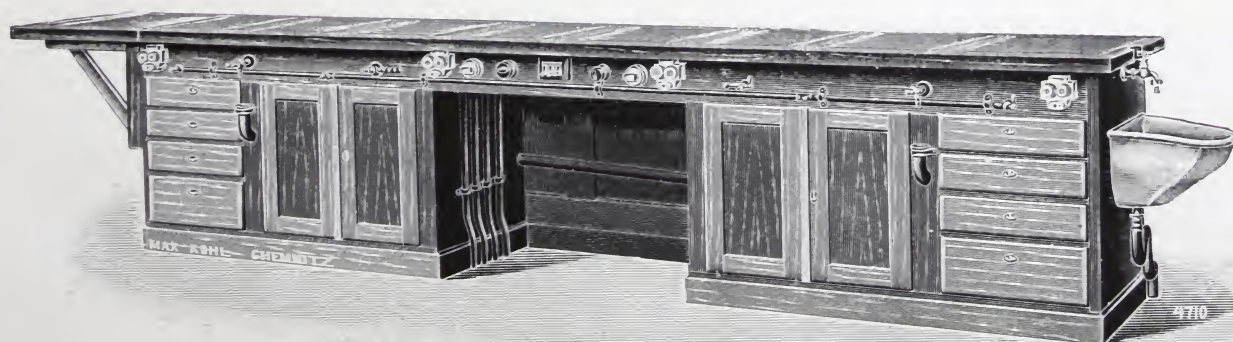


Description and prices of the
figured tables on request.

Chemical Institute, Breslau.



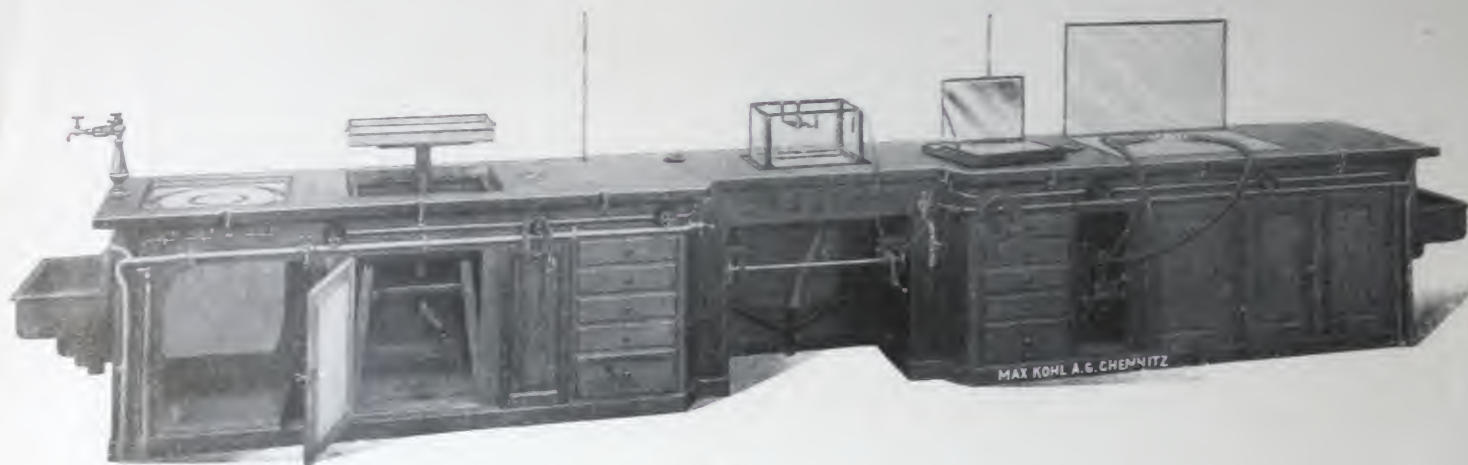
Experimental chemistry of the University, Leipzig.



50 041. 1:32.
Physics Lecture Table (as suggested by Grimsehl).

Lecture Tables.

Description and prices of the figured tables on request.



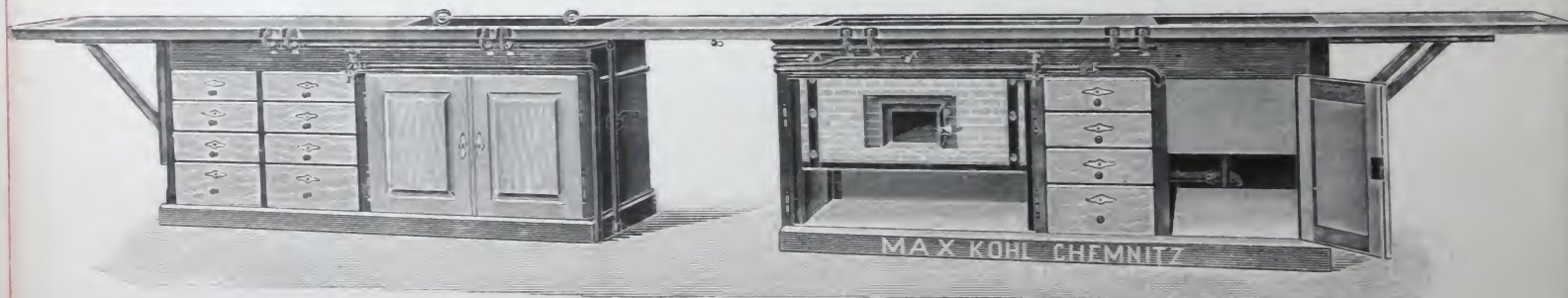
1:35.

Lecture Table, in the Pharmaceutical Institute of Breslau University.



1:42.

Lecture Table, in the Chemical Institute of the Technical High School, Danzig-Langfuhr

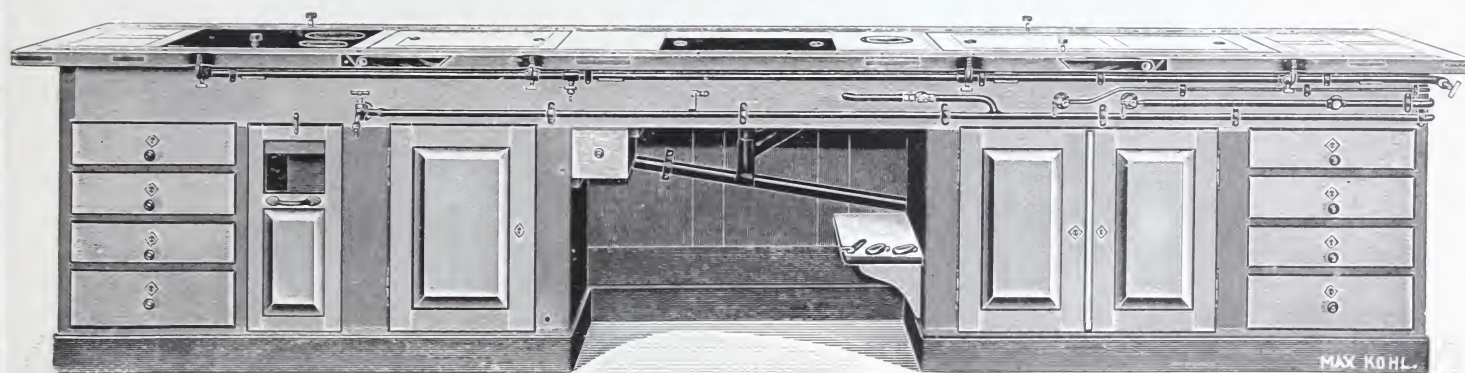


1:40.

Lecture Table, in the Physics Department of the Charlottenburg Technical High School.



50001. 1:15.



50003. 1:22.

Lecture Table (as suggested by Weinhold), chiefly intended for instruction in Physics, but also adapted for Chemistry in the case of a common room being used for both Physics and Chemistry (W. D., Plate III and Figs 13, 14, 15) (see Fig. 50 001 and 50 003).

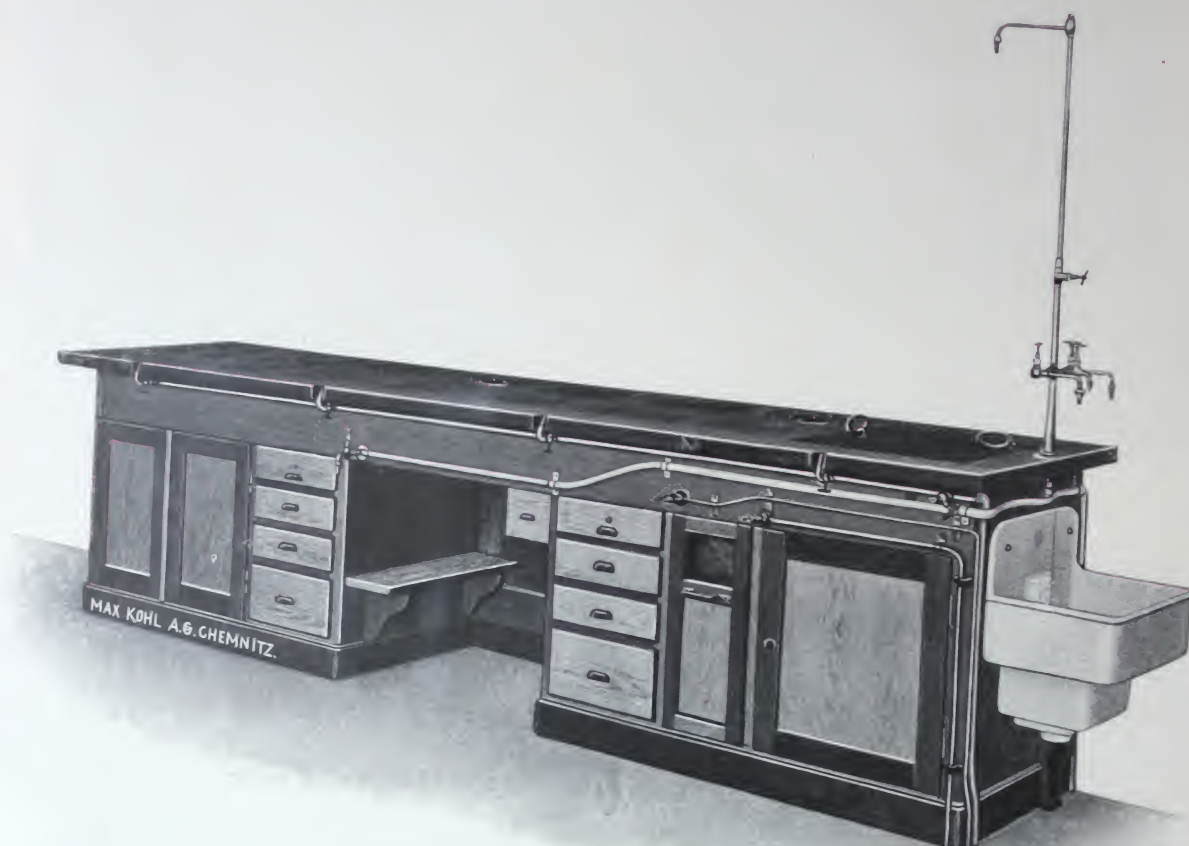
£ s. d.

With oak top impregnated with linseed oil	{	List No.	50 001	50 002	50 003	50 004	50 005
		Length of Table m	3	3.5	4	4.5	5
		Price of Table	£ 25.0.0	27.10.0	30.5.0	33.0.0	35.15.0

The approximate gross weights, with batten packing are: about 300 kg for a length of table of 3 m, 350 kg for 3.5 m, 400 kg for 4 m, 450 kg for 4.5 m and 500 kg for 5 m.

The table is 90 cm. in height and 80 cm. in width. The **top** is oak, 40 mm. thick, is composed of framework and pannellings, and is varnished with three coats of hot linseed oil or stained and acid-proof black (at a slight extra cost). At the left hand side of the table top a slate slab, 54 cm. in length and 54 cm. in width is let in, upon which work involving the use of acids can be carried out without in any way damaging the table top. The **body** of the table is built of pitch pine, is stained and varnished and has an oak fillet at the base. The inner sides and the bottoms are of deal. With a length of 4 m. the table has 8 drawers, 2 cupboards, one box for waste paper, etc., 1 drawer for glass tubes, 1 wall bracket for taking gas burners, 2 tube flaps; **gas supply pipe** with 3 taps having unions bent upwards to prevent tearing of the hose; also 1 tap for the heating arrangement, and 1, having a wide bore, for combustion furnaces, for filling the gasometer, etc. There is also a **water supply pipe**, with 2 screw down taps (one being screwed for the hose pipe): 1 **length of piping** fitted with 1 tap; for **suction air**; 1 **length of piping** with 1 tap and a hose support, for **compressed air**. There are 2 **porcelain sinks** in the table top with strainer let in and with lead waste pipe. One stoneware **draught channel** for gases and noxious fumes, 1 **heater** for electrical apparatus, a **cavity** for working with mercury, 1 **pneumatic trough** (zinc), with direct water outlet, overflow, outflow, valve and bridge for suspending; 1 **electric lead** with two wood covered rails let in the table top, these rails having plug holes every 25 cm. These holes take the 4 plug terminals with insulated handles which are supplied with the table. A terminal connected up to the water supply pipe serves to make a good earth. The **covers** for the sinks and the draught pipe are constructed of iron and are let into iron rings. The lid of the pneumatic trough consists of a slate slab. The latter cover, and also the lid of the mercury trap and heater are lifted off by means of detachable handles.

All pipe lines are laid ready as far as the floor.



50 052. 1:30.

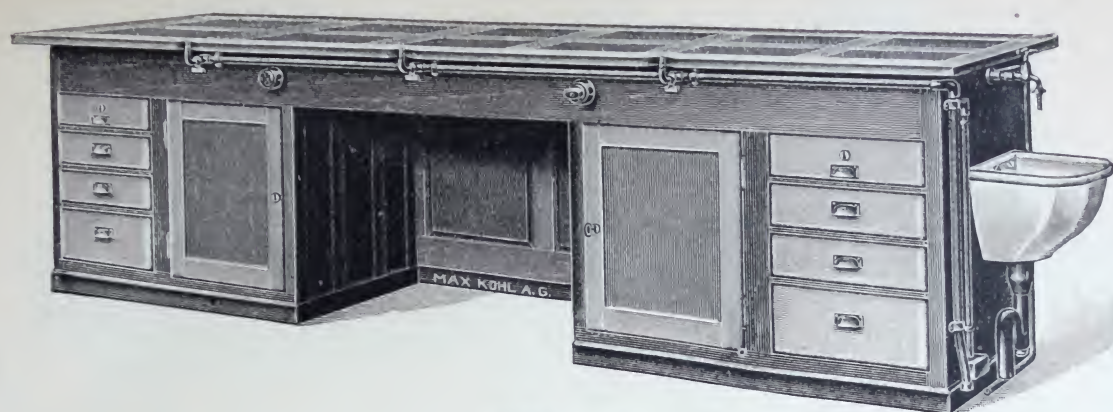
Chemical Lecture Table (Figure).

£ s. d.

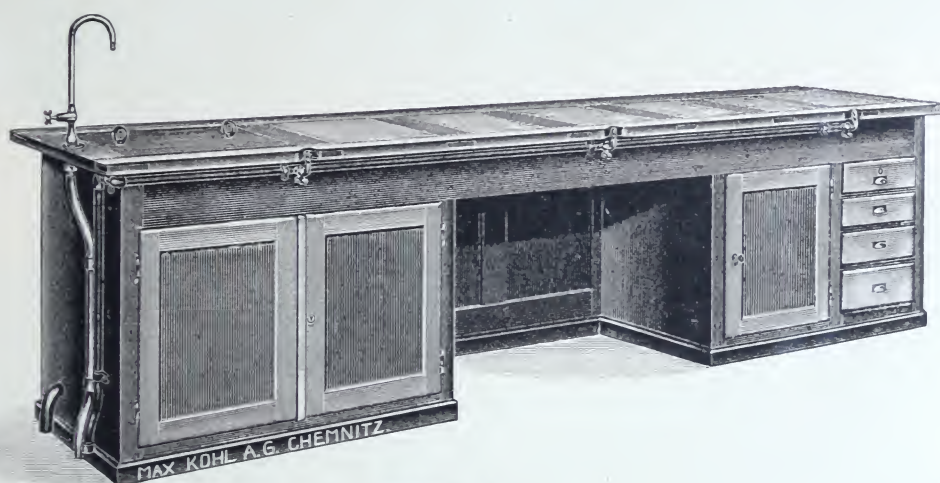
With oak top	List No.	Length of Table m	50 050	50 051	50 052	50 053	50 054
			3	3.5	4	4.5	5
		Price	£ 29.14.0	34.10.0	36.6.0	38.10.0	41.16.0

The approximate gross weights with lath packing are: about 300 kg for a length of 3 m, 350 kg for 3.5 m, 400 kg for 4 m and 450 kg for 4.5 m.

The table is 90 cm. in height and 80 cm. in width. Top of oak or teak 40 mm. thick is composed of frame and panels, and it is stained an acid-proof black. The body (the frame and panels of which are of pitch pine) is carefully stained and varnished. The bottom fillets are of oak. The body has with 4 m. length 8 drawers, 1 double-doored cupboard, 1 single-doored cupboard, 1 narrow drawer for glass tubes and one rack for containing gas burners. The table has a gas lead provided with 4 gas taps of 4 mm. bore and a tap of 8 mm. bore, for filling the gasometer and for heating the combustion furnaces. The gas taps are arranged in front under the table top and have hose unions bent upwards in order to prevent the hose tearing. The water lead ends in a tall nickelled standard with rotary outflow pipe, the latter serving for the filling of tall vessels and gasometers. Underneath this is a low pressure water standard with three water taps, two of the latter having screwed hose connections. On the same narrow side of the table is a laboratory basin (German design) of hard baked white earthenware, with a raised back wall, deepened bottom, overflow, drainer and stoneware valve for the purpose of carrying on continuous washing operations. Further, the table is fitted with piping with tap for compressed air, 1 pipe line with tap for air intended for obtaining vacua, a large and deep pneumatic trough (zinc) with zinc bridge, overflow pipe, draining valve and a slate slab as lid. In addition the table is provided with 1 draught pipe for gases and noxious fumes, 1 porcelain sink with strainer and lead waste pipe: 1 hollowing for working with mercury and 1 electric lead consisting of 2 wood covered metal rails let into the table, the rails having plug points every 25 cm. The holes take 4 plug terminals, with ebonite handles, supplied with the table. The lid of the sink and of the draught pipe are constructed of iron and are let into iron rings. All pipe lines are fixed complete down to the floor.



50 049. 1:28.



82 089. 1:30.

Simple Lecture Table for Secondary and Continuation Schools, Figure.

£ s. d.

List No.	50 046	50 047	50 048	50 049
Length of Table m	2.5	3	3.5	4
Price £	15. 8. 0	17. 12. 0	20. 7. 0	24. 4. 0

The gross weights are given only approximately and hold for **lath-packing**: about 250 kg for a length of 2,5 m, 300 kg for 3 m, 350 kg for 3,5 m and 400 kg for 4 m.

The top is 30 mm thick oak, composed of frame and pannellings, and thrice coated with hot linseed oil. The body is of pitch-pine carefully stained and varnished; and the inner side walls and bottoms are constructed of deal. The table has according to length 8 drawers and two cupboards; it has gas and water supply pipes and 2 to 4 gas taps (according to length) with hose unions curved upwards. On one of the narrow sides is a white porcelain basin with draining valve, siphon and waste pipe. The gas and water leads are laid ready on the table down to the floor.

82 089. Lecture Table for Biology Class Rooms, Figure, length 3,50 m, breadth 80 cm, height 90 cm 19. 16. 0

The top is of 30 mm thick oak, being composed of frame and panelings and coated thrice with hot linseed oil. The body is of pitch-pine. It has 4 drawers, the upper one of which can be shut, 1 single-doored cupboard and 1 double-doored cupboard with shelves. The table has gas and water leads with 3 gas taps with hose unions turned upwards. The water lead finishes above the table in a water-tap of passage with standard 0,30 m high. Besides this water tap there is a basin of rolled zinc, 45×45 cm large and 30 cm deep with draining valve and bottom of a sieve. The basin is covered with a slate slab and serves for keeping little aquariums, plants etc.

Students' Work Tables.



82 090. 1:28.



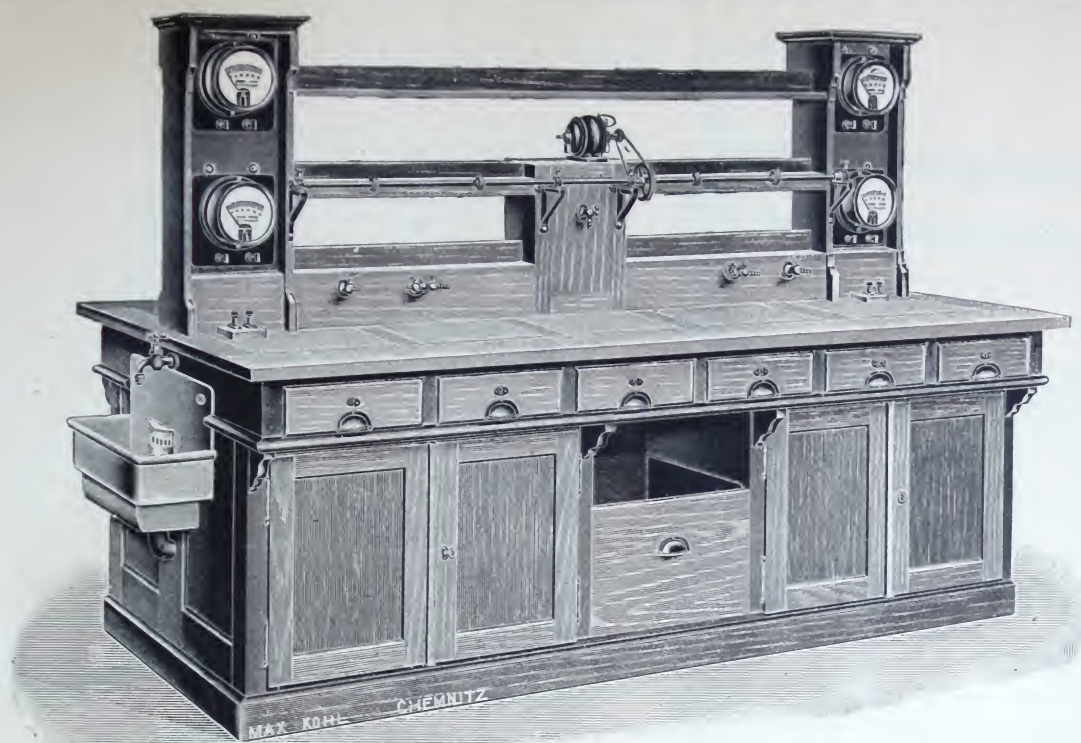
50 291. 1:20.

- 82 090. **Students' Work Table with Table Substructure**, Figure, standing alone, intended for 8 students, with gas and water leads, bottle stand and laboratory basin. £ s. d.
21. 3. 0

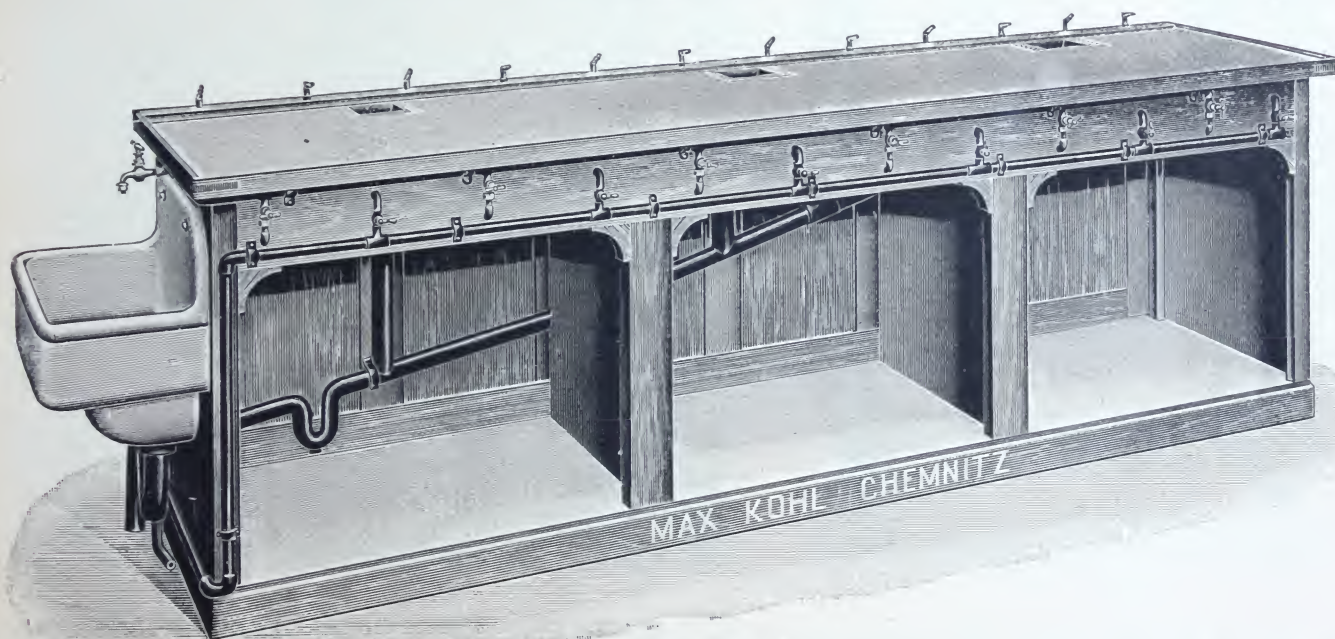
The table top is 3.60 m long, 1.40 wide and has 4 work-places at each side along the length of the table. The table is 0.90 m high and has 2×4 drawers, which can be shut. The water lead finishes in a standard with double water tap. Being conical screwed to hold hose. Under these taps a white stoneware laboratory basin is mounted

- 50 291. **Students' Work Table with Cupboard Substructure**, Figure, standing alone, intended for 8 students 40. 8. 0

The table, which stands away from the wall, is 3 m long, 1.40 m wide, 0.90 m high. The top is of oak. The body has at each side along the length of the table 4 drawers above and underneath these, somewhat set back 4 small cupboards with shelves. A white enamelled wrought-iron bottle rack is fixed on the table top and has two glass shelves running the entire length. The table is equipped with gas supply pipe with 8 unions, water supply pipe, 2 standards each with 3 taps and underneath a laboratory basin.



50 369. 1:24.



50 373. 1:18.

50 369. Students' Work Table for Electrochemistry, Figure, for 4 students

This work table is designed to stand away from any support, is 2.50 m long, 1.60 m wide and 90 cm high. The **top** is of oak-wood and impregnated thrice with hot linseed oil. The **body** contains on each longitudinal side 6 drawers, and underneath these, somewhat set back, 2 double-door cupboards with shelves and a box for waste paper and the like. The table top has a reagent stand, with a housing at the right and left hand sides for containing electrical measuring instruments. The table is provided with gas lead, having 8 stopcocks, water lead with 8 stopcocks; on each of the narrow sides there is 1 large water tap; 2 white laboratory basins; 1 transmission shaft on each of the long sides driven by a small $\frac{1}{16}$ HP. D. C. motor, with 4 bearings, 1 driving pulley, 4 small spindle-rings each having 2 pulleys and 4 adjusting rings; 8 terminals; 4 dead-bead precision ammeters and 4 voltmeters. The following are given in with the table: 4 sliding resistances for low currents; 4 pairs flexibles being provided with the necessary endconnectors.

£ s. d.

74 5. 0

50 373. Distilling Table for Laboratories, Figure

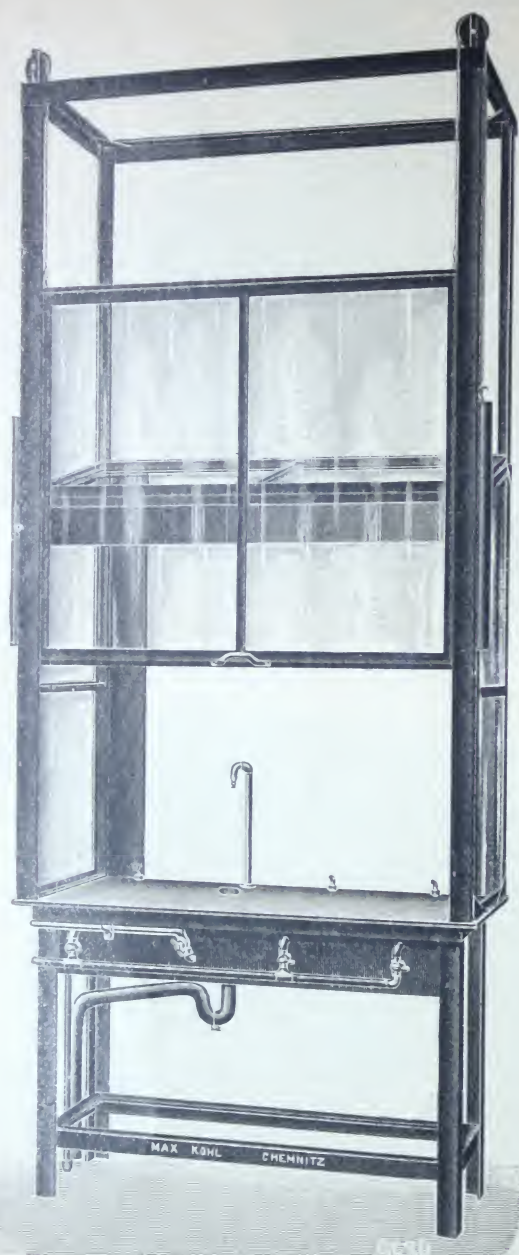
The table is 3 m long, 60 cm wide, 90 cm high. The top has a round edge running round it. The surface of the table is completely covered with rolled sheet lead; it slopes down somewhat towards the back, and at that side it has a channel running the entire length for carrying off any liquids spilled; for taking off the water 3 waste funnels are let into the top of the table.

The body has 3 large spaces and has a back wall. From the gas and water leads each six cocks branch off over the entire length of the table, on the front side, while the delivery pipes are carried under the table top, and terminate in bent hose unions above the table top at the back.

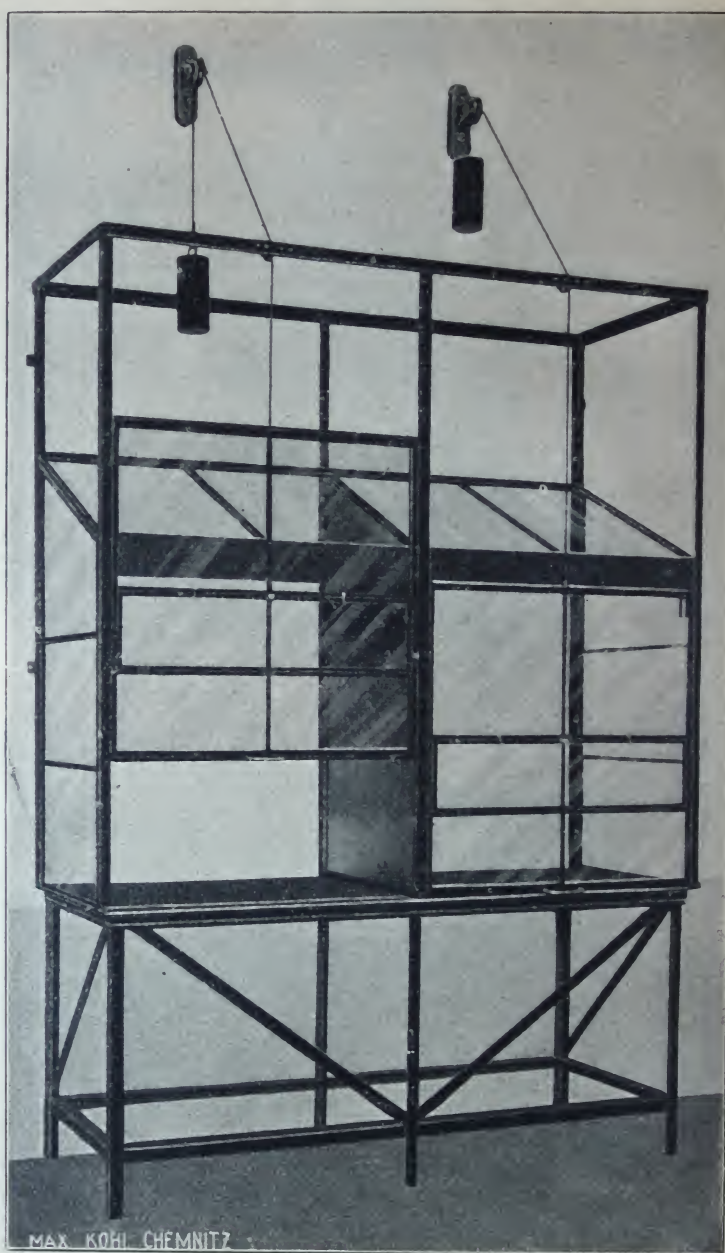
On the narrow side of the table a tap for the water lead is fitted, also a large laboratory basin with deepened bottom.

18. 3. 0

Iron Stink Cupboards.



50303. 1:17.



50306. 1:25.

Iron Stink Cupboards with Table Substructure and open leading of the balance-weights for the sliding windows (cf. Figs. 50303 and 50306).

These cupboards combine ease of inspection with small amount of room requisite.

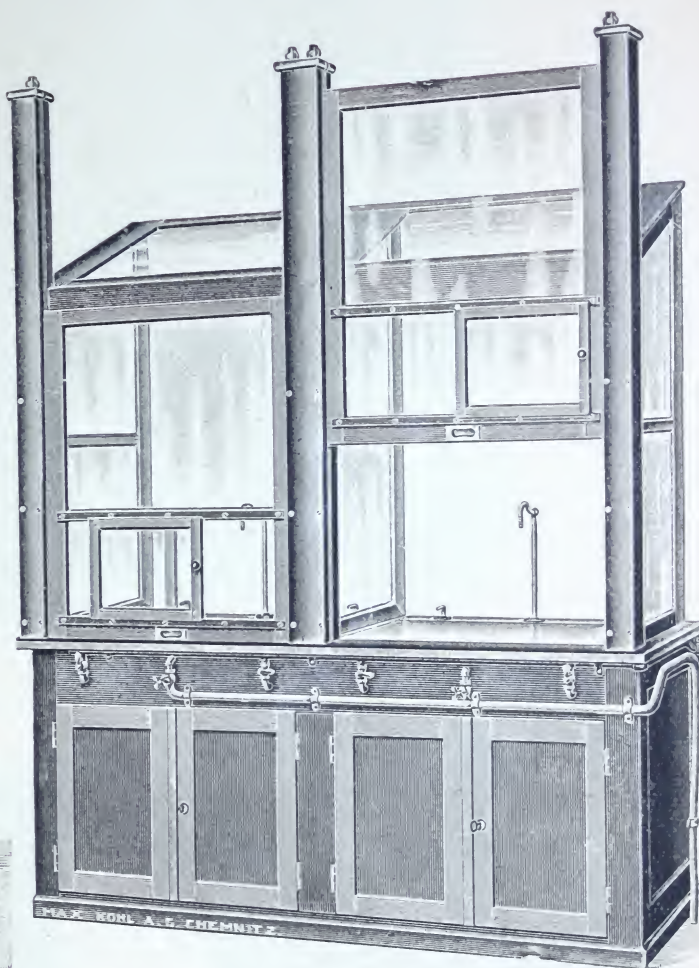
Iron Stink Cupboards with one Compartment	List No.	50303	50304	50305	
	Length m	1.00	1.30	2.00	
	Depth m	0.70	0.70	0.70	
	Height m	2.80	2.80	2.80	
	Price with Leads £	19. 5. 0	21. 3. 0	24. 4. 0	
Iron Stink Cupboards with a number of Compartments	List No.	50306	50307	50308	50309
	Number of Compartments	2	2	3	3
	Length m	2.00	3.00	3.00	4.00
	Depth m	0.70	0.70	0.70	0.70
	Height m	2.80	2.80	2.80	2.80
	a) Without Leads £	25. 6. 0	29. 14. 0	34. 13. 0	39. 12. 0
	b) With Leads £	31. 10. 0	35. 15. 0	44. 10. 0	50. 12. 0

Cupboard No. 50309 has two small compartments each 1 m long at the right and left and 1 large compartment 2 m long in the centre. The partitions are of glass. In the case of No. 50306, the partition is of sheet iron; this can also be made of glass, if desired. Cupboards Nos. 50306 to 50308 have 2 or 3 equally large compartments, each compartment having a sliding window.

The iron stink cupboards are also supplied in any other length or depth desired.



50297. 1:18.



82091. 1:21.

50297. **Stink Cupboard with Cupboard Substructure, Figure, 1,15 m long, 0,7 m deep, 2,3 m high, framework of pitch-pine, with gas and water leads with slate slab and oak-wood frame** £ s. d.
12. 10. 0

The gas and water leads are supplied ready mounted; the gas lead terminates in 2 hose unions inside the cupboard, the taps being fitted outside on the front. The cupboard has a water tap standard inside and a water outlet, and a water tap outside.

82091. **Stink Cupboard with Cupboard Substructure, with two Compartments, Figure, 2,00 m long, 0,7 m deep, 2,3 m high, each compartment 1,00 m long, of pine** 19. 10. 0

The compartments are separated by partitions of glass. The cupboard has an oak table top, into which 2 acid-proof polished slate slabs are inserted. Each compartment has 2 gas-outlets and 1 water-outlet, underneath a lead water waste with strainer and lead waste pipe with seal. The gas and water taps are placed outside, the cupboard in front. Each of the large sliding windows has a little sliding window at the right.

Cupboards.



50 282. 1:27.

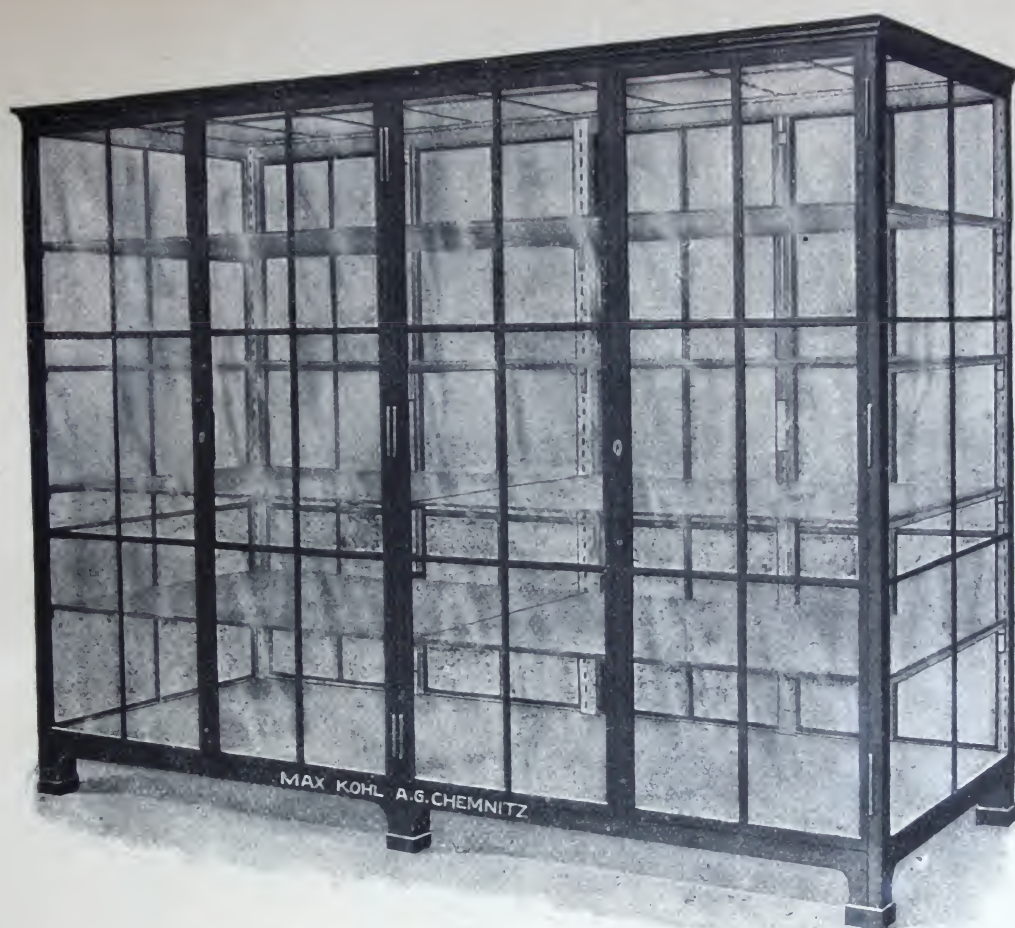


82 092. 1:22.



82 093. 1:25.

Kl 5288.
7216, 7226.



82 094. 1:28.

- | | £ s. d. |
|--|-----------|
| 50 280. Glass Cupboard (standing alone) for storing Physical Apparatus and Scientific Preparations, 3 m long, 2,3 m high, 0,85 m clear depth; constructed of pine, with 6 dust-proof double doors, fitted with bascule locks, with 4 shelves resting on notched ledges. Side walls, doors and top glazed. The cupboard is lacquered outside, and is coated inside with light-blue oil paint | 25. 15. 0 |
| 50 281. — The preceding, 2,3 m long, 2,3 m high, 0,85 m clear depth, with 4 double doors, otherwise as previous item | 20. 8. 0 |
| 50 282. Wall Cupboard for storing Physical Apparatus and Scientific Preparations; 3 m long, 2,3 m high, 0,6 m clear depth, Figure, with 3 dust-proof double doors, fitted with bascule locks, otherwise as preceding | 18. 18. 0 |
| 50 283. — The preceding, 2,3 m long, 2,3 m high, 0,6 m clear depth, with 2 double doors, otherwise as preceding | 15. 5. 0 |
| 82 092. Chemical Cupboard, of pine, Figure, the upper part with folding-shutter with somewhat advanced list for setting away bottles, 1,20 m long, the body 0,50 m deep, 0,95 m high with one shelf the top 0,30 m deep and 1,25 m high with 5 shelves | 9. 10. 0 |
| 82 093. Iron Wall Cupboard for Models and Physical Apparatus, Figur, 2,00 m long, 2,50 m high, 0,50 m clear depth, with 2 double doors, fitted with bascule locks, glazed doors | 18. 15. 0 |
| The cupboard is despatched in parts and therefore it must be assembled on the spot. Three shelves which rest on adjustable perforated iron rails can be fixed in different high. The interior and exterior of the cupboard is coloured with oil-colour. | |
| 82 094. Iron Museum Cupboard (standing alone) for Physical Apparatus and Models, Figure, assembled of the narrowest possible iron frames; quite dust-proof, especially the doors, so constructed that they may be despatched in parts and assembled on the spot | 82. 10. 0 |
| The cupboard rests on 6 feet, has sheet metal shelves, and a cornice running round the top, and on each side 2 double doors with safety bascule locks. The doors, walls and the top are glazed (wooden shelves at lower price). The cupboard contains 4 shelves of stout glass. The shelves rest on adjustable perforated iron rails. Two shelves take up half the depth and 2 the entire depth of the cupboard so that also higher apparatus may be placed in the cupboard. The iron parts are coloured black inside and lighter outside. | |
| Length: 3 m, height: 2,5 m, depth: 1 m. | |

Darkening Apparatus.

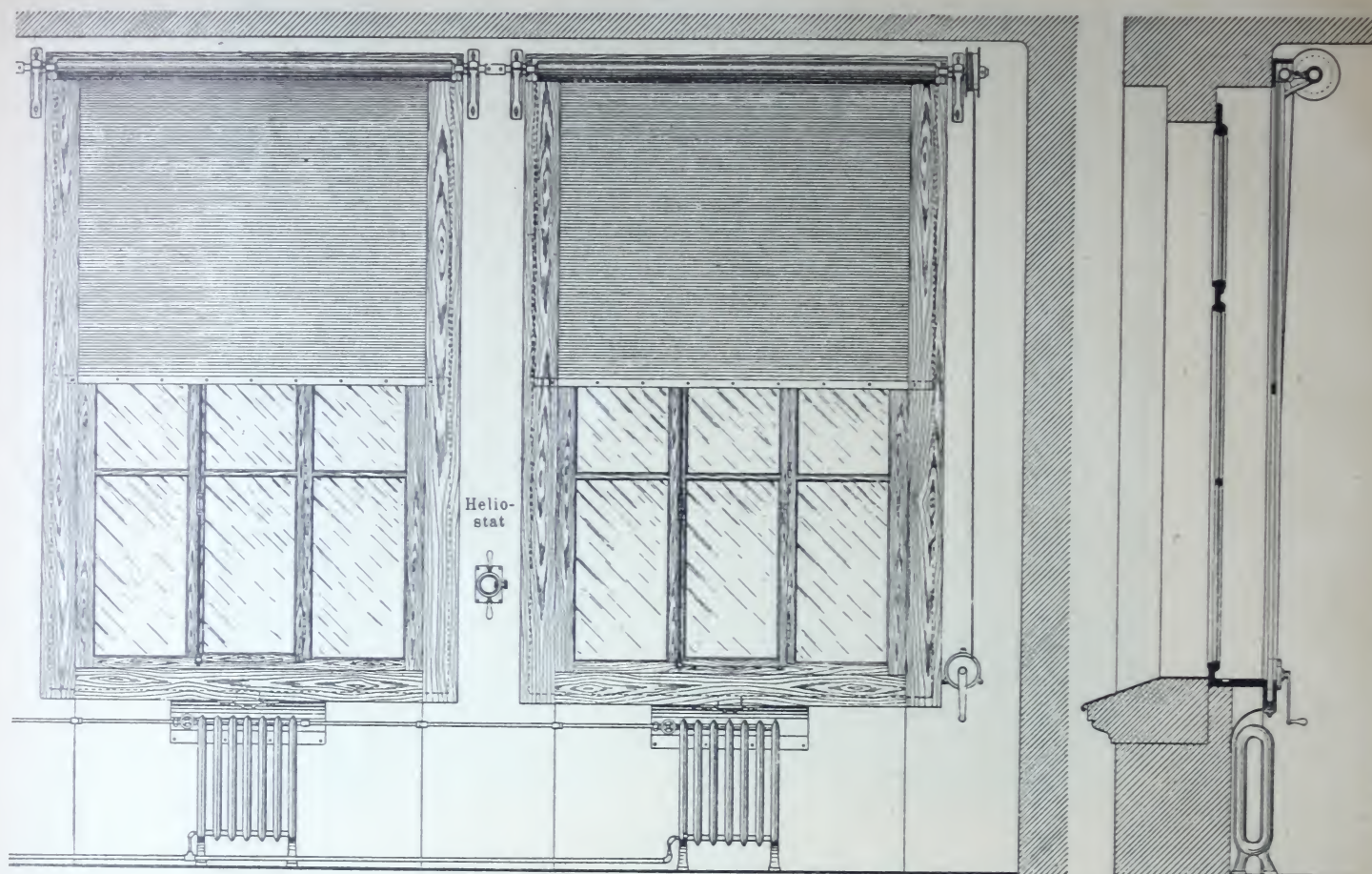


Plate III. Darkening of the Lecture Room 1:40.

The devices consist of **roller blinds of black, light-tight felt** fixed to shafts composed of Mannesmann tubes. The rods rest in iron wall bearings placed above the windows. At the lower end the blinds have weighting bars and move over guide bars and between broad wood frames of \sqcap shaped section. These frames are so constructed that they completely surround the windows. When a number of windows in a row or on more than one side of a room are to be darkened simultaneously, the iron rods are coupled together or connected above the corners of the room by couplers. For facilitating transport the frames are delivered in single sections which have to be assembled on receipt.

The substantial construction of the bearings and the power-ful transmission shafts, which can be made to any size, are an absolute necessity. The question of cheapness should not be allowed to decide, but if the devices are to work continuously with certainty, the main question is construction as regards the woodwork of the frames, the material and the transmission parts.

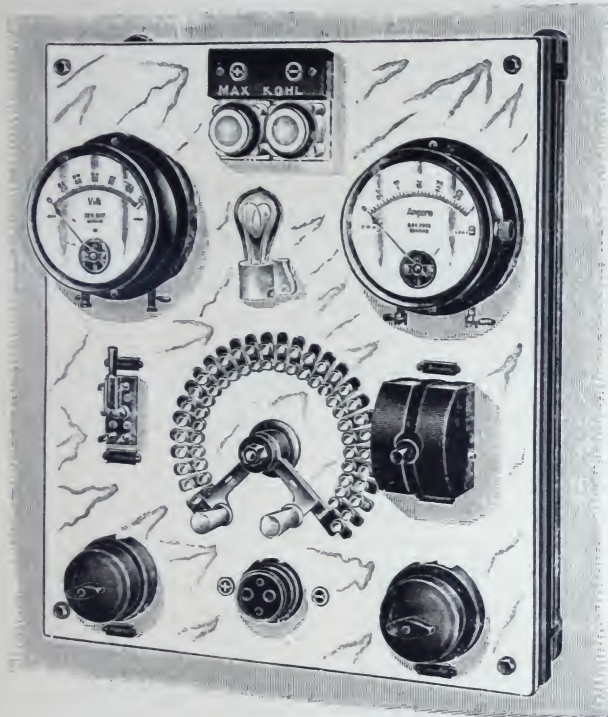
The **material** of which the curtains are made is of primary importance. This is manufactured expressly for the purpose; it is absolutely light-tight and moth-proof, and consists of 3 layers bound together — a product of many years' experience. The fabric is 3.5 mm thick. This thickness is necessary to obviate any chance of the curtains shrinking and to offer sufficient resistance to the draught. The disadvantages of darkening the windows by roller blinds can always be traced to the employment of material which is unsuitable for the purpose. By using our system of darkening it is possible to exclude the light entirely over surfaces to 5 metres width and 9 metres height.

As the price of the device is calculated according to the space to be obscured and the length of the transmission parts, it is necessary when sending inquiries to give an elevation and section of the window wall and to state the height and width of the window bay, of the distance apart of the bays, and their distance from the windows and the walls, so that we may be enabled to quote the price correctly. If there are iron girders over the windows, or pipe-lines, heating units, or the like in the neighbourhood of the windows, these should be shown in the drawing.

We shall be glad to submit drawings, prices and references as to work already carried out by us in this connection.

The darkening apparatus are supplied for both working by hand, Figure, and motor-driven.

Experimental Switchboards and Experimental Resistances for Educational Institutions and Laboratories.



The experimental switchboard must be so constructed that on connecting up to a heavy current network, work can be carried on with a low or a high current intensity, as also at a high and a low voltage. The last condition especially must be satisfied in the case of apparatus working with an interrupted current, such as Ampere's table, the spark coil with platinum interrupter, the electric bell, etc. It must be observed that this is not realised simply by inserting resistances in series, since at the moment of breaking the circuit the full network voltage would prevail at the contacts, and the contacts themselves become fused together. Rather must the voltage be distributed by a shunt method of grouping so that it is impossible for the voltage to exceed a certain value.

The switchboard must in addition be provided with measuring instruments for the current and voltage. In the case of the potential, it must be possible to measure the voltage at the apparatus as well as in the network; it is also desirable to measure both the total current taken from the main and the current consumed in the experimental apparatus alone.

We have constructed a switchboard which entirely fulfils the conditions just prescribed and permits of the carrying out of all experiments which may need to be conducted in teaching or in the laboratory.

The demands put upon the experimental switchboard are very great, for the highest possible current-density is desired as well as a regulation in very close stages. This circumstance must be taken into account both in the construction of the regulating device and the dimensioning of the resistances. The regulating apparatus is therefore constructed in the **Double Switch Contact form**. The double switch contact arrangement consists of contact pieces arranged in a circle, upon which slide the contact springs of two levers insulated from each other. The figures at the side of the contact pieces give the resistance in ohms between one contact piece and the contact piece 0. The handles of the levers are placed laterally on the levers themselves, so that both switch contacts (or levers) can be placed on the same contact piece. This switch permits (1) the employment of the resistances in series with the apparatus; (2) one portion of the resistance being put in series with the apparatus to be tested and another portion in parallel with the same, i. e., in shunt, thus obtaining a division of tension.

By this arrangement alone a multiplicity of positions in the regulating stages is attained, and this can be made use of in its entirety for instructional purposes and in the laboratory, as the transition from one form of grouping to another in the arrangement which we have adopted can be carried out with great rapidity by simply cutting a single switch in and out of the circuit. The resistance is connected up as a series resistance when the shunt switch is open, and as a shunt resistance when the shunt switch is closed. By employing a large number of contacts (30 in the ordinary and 21 in the simple type of construction) the graduation is brought to a suitable degree of fineness. Another important advantage is secured by the adoption of the double contact lever arrangement, viz., the possibility of securing coarse regulation with one handle and fine with the other; this has proved to be of great value, and, indeed, almost indispensable, for educational purposes and in the laboratory. If it be desired to keep the fineness of regulation within still narrower limits, a Sliding Rheostat is put in series with the apparatus to be tested; this type of resistance is especially desirable in laboratories. The resistances belonging to the switchboards are dimensioned to correspond to the wide range of regulation which is always demanded of experimental switchboards. By organically combining the resistances with the switchboard to which they pertain, it is not generally necessary to have a special room for the resistances. The resistances are designed for continuous loading with the currents stated in the price list, when the correct contacts are used.

Arrangement of Connections.

Method I. Rheostat as Series Resistance.

This arrangement can be employed with advantage for the charging of accumulators, the excitation of electro-magnets, and for working an arc lamp up to the current capacity of which the switchboard permits. The illustration appended shows the scheme of connections.

Switch for Shunt open. — Switch contact I of the double switch contact is on the last contact to the right, and switch contact (or lever) II on 0. The current starting from +, takes the path indicated in the figure by thick lines and arrows: positive pole 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, plug box 12 (the experimental apparatus is connected to this), 13, 14, lever II of the double switch contact, resistance 15, 16, 17, lever I, 18, 19, 20, 21, 22, 23, negative pole. The diagram shows, in addition, by dotted lines, the connection of the shunt leads at 6, 7, 9, 10 to the ammeter switch, and at 5 and 19 and 11 and 13 respectively to the voltmeter switch (and from these switches to the measuring instruments themselves). The switch for the voltmeter is placed on „Netzspannung“ (network voltage), and the ammeter switch on „Stromstärke im Apparat“ (current in the apparatus). By changing over the latter to „Gesamtstromstärke“ (total current) will, with this method of connecting, give the same deflection of the pointer.

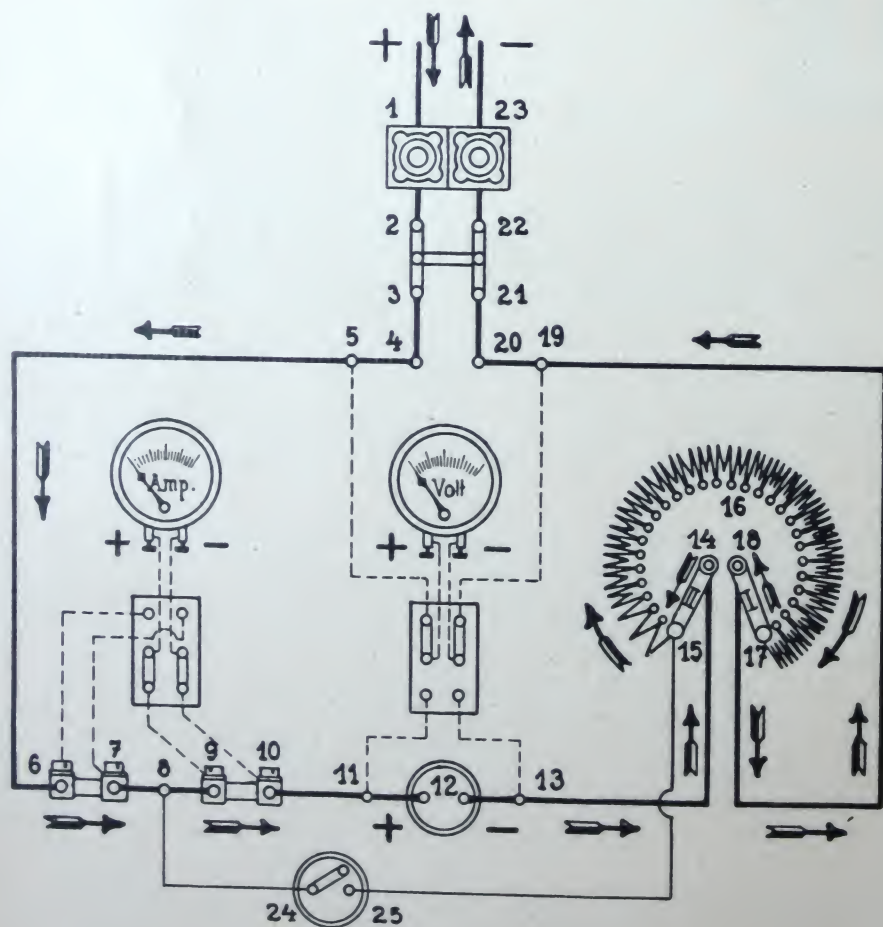
In this method of connections the resistance inserted is always equal to the difference between the numbers placed alongside the contact pieces on which the lever is placed. At the position of the lever indicated in Diagram I the resistance in circuit is the total resistance of the double contact lever, e. g., by employing a Type A₁ switchboard as listed, it is 36 ohms. If the plug box is short circuited by connecting the contacts of same with a terminal, we have, with the position of the lever given:

with Type **A** and 110 Volts working pressure a current of $\frac{110}{36} = 3.05$ amperes;

with 160 Volts working pressure $\frac{160}{36} = 4.44$ amperes;

with Type **B** and 220 Volts working pressure $\frac{220}{48} = 4.58$ amperes;

with Type **C** and 110 Volts working pressure $\frac{110}{24} = 4.58$ amperes.



Method I.

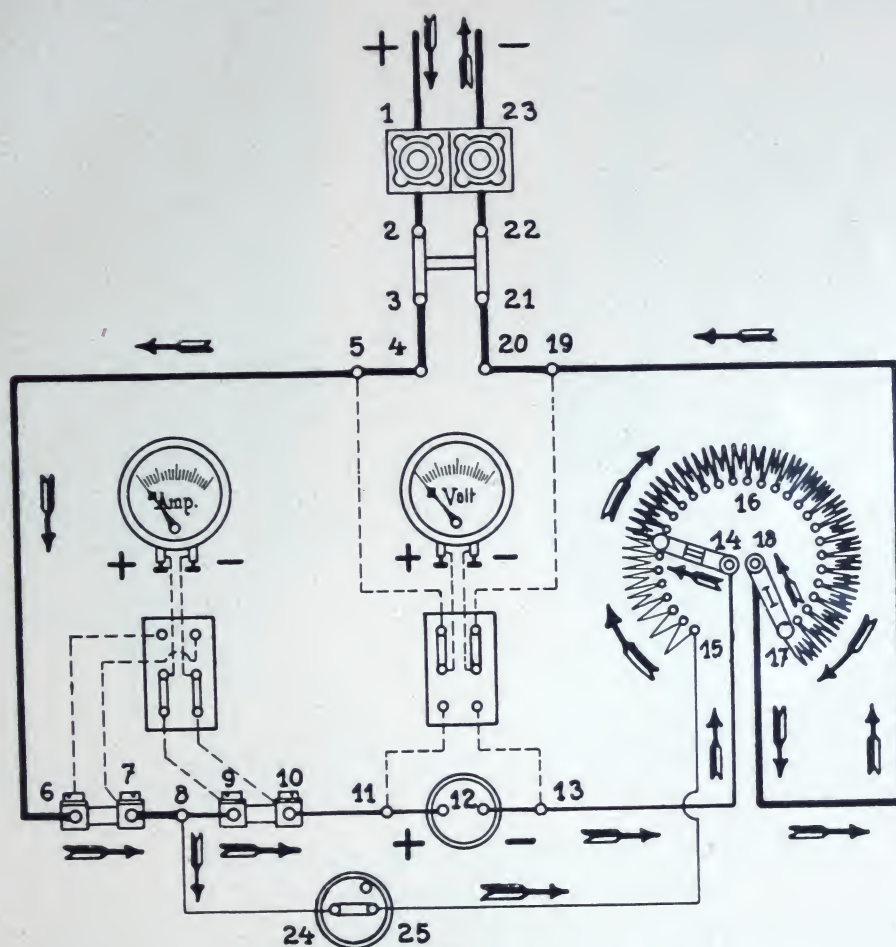
The thickness of the wire forming the resistance spirals increases in steps for a maximum continuous load of I, in Type **A** 5—30 amps., in Type **B** 5—20 amps. so that even when the plug box is short circuited or when the resistance of the apparatus put in the circuit is very low (e. g., in glowing experiments), the resistance spirals do not become unduly heated when only Switch Contact I is used and the currents of 30 and 20 amps. respectively are not exceeded. As a rule Switch Contact I will first be placed on 0, and Switch Contact II on the highest resistance value to the right, and then Switch Contact I will be turned backwards; finally, the current is slightly increased with the aid of Switch Contact II.

Method II. Rheostat as a Shunt Resistance for Division of Tension.

The connections are the same as the preceding, only the switch for the shunt is closed. Switch Contact I is on the last contact to the right and Switch Contact II on another contact. The current, starting at + follows the course shown in the illustration by lines and arrows:

+ , 1, 2 8 { 9, 10, 11, 12, Expt. Apparatus, 13, 14, Lever II } 16, 17, Switch Contact I, 18, 19 23, -.

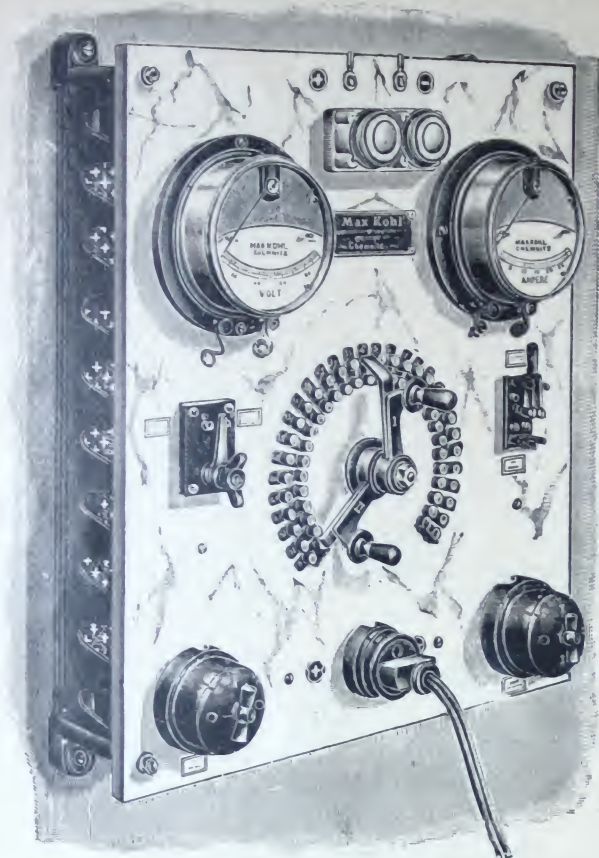
24, 25, 15



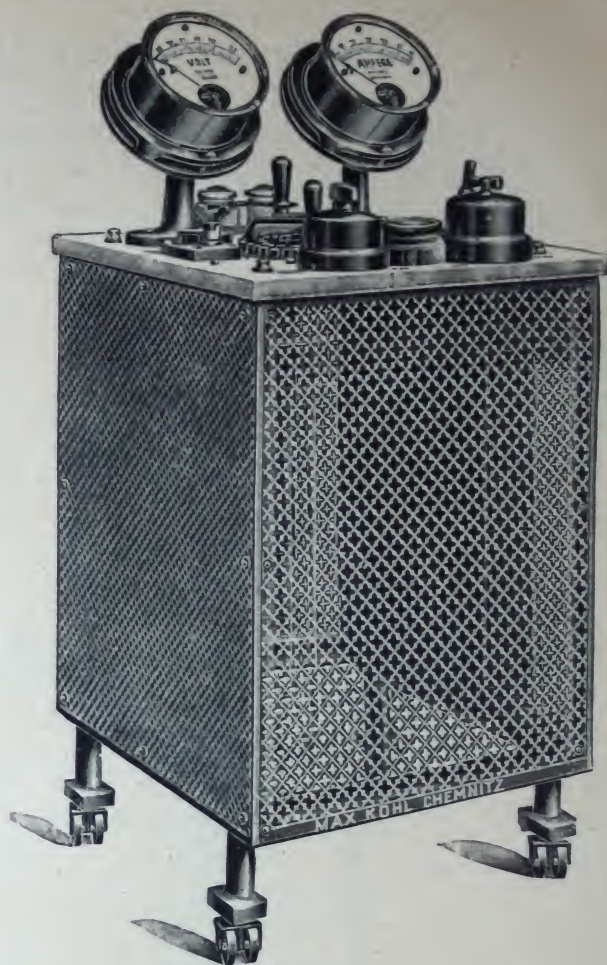
Method II.

The current branches off to the two shunts, a portion going from 8—14 in the apparatus, the other part passing by the shunt switch into the current regulator; at the contact stud on which Switch Contact II rests the two branches re-unite and from this the whole current flows to the negative pole. In other words, a portion of the potential prevailing at the ends of the resistances 15 and 17 (which prevails at 14 and 17) is removed and conducted to this part of the apparatus. **Potential Distribution.** — The unshunted current is shown in the illustration by thick lines, and the shunted by thinner lines. The farther apart the Switch Contacts are removed, the lower the tension existing in the apparatus, and the weaker, therefore, the current flowing through the apparatus. As a rule Switch Contact I is placed on the greatest resistance value to the right and Switch Contact II on the lowest to the left, the latter being turned forward until the pressure desired at the apparatus (and therefore the current density) is attained. If Switch Contact II is near the left hand end contact, and if it be desired to increase the current slightly, it is better to move Switch Contact I back than to move No. II forward. Even when this method of connections is adopted it is thus possible to obtain fine regulation with one Switch Contact and coarse with the other.

If it be desired to feed with current an apparatus which works with an interrupted current (e. g. an induction coil with platinum interrupter or an Ampere table), it may be desirable that at the moment of making the circuit not too high a pressure prevails so as not to burn the contacts by the spark at break. In such cases, when large currents are being used, Switch Contact II should be left in the region of the smaller resistances, while Switch Contact I should be turned backwards. The pressure at the apparatus at the time when no current is being taken off, is to the working voltage as the resistance values placed alongside the contacts on which the Switch Lever rests are to each other.



50471. 1:8.

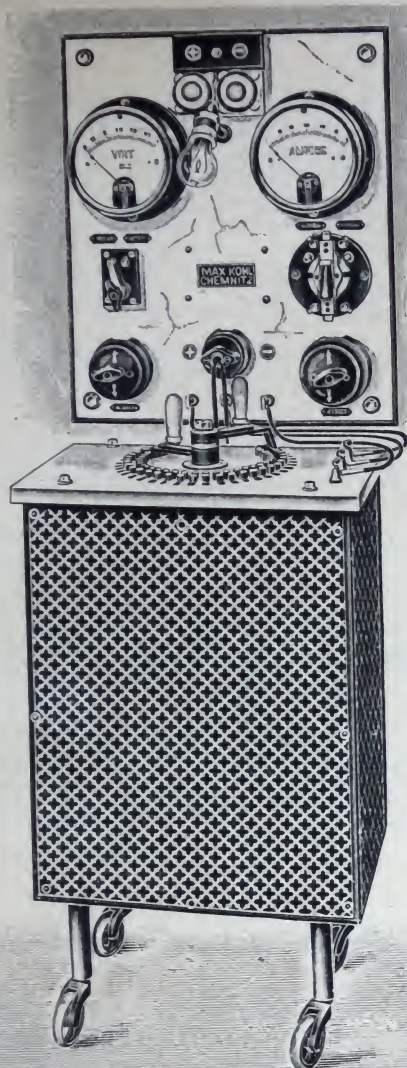


50472. 1:10.

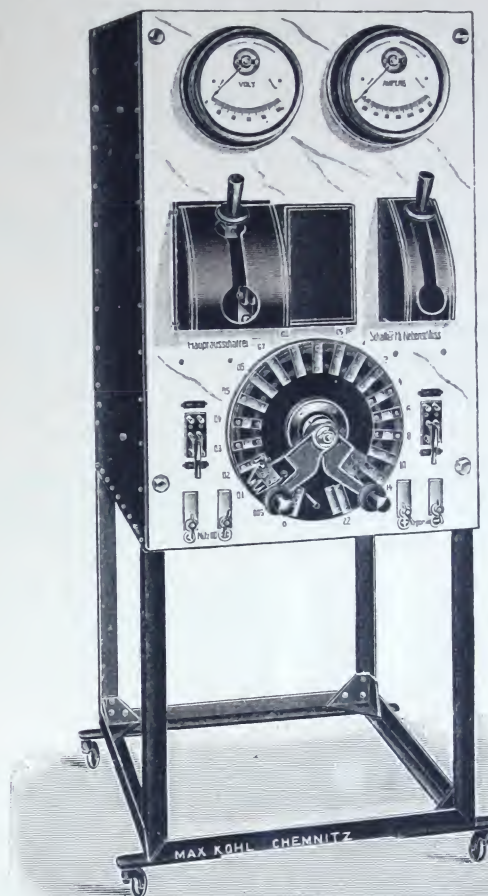
The currents and voltages given assume the resistance of the apparatus to be connected up to be 10 ohms.

Direct Current Switchboards with one Circuit, with Standard Instruments.

50471. Experimental Switchboard Type A, (Wall Pattern) , Figure, for connecting to 110 – 160 volts C. C., for taking currents of 0,03—30 amperes and voltages of 0,3—110 (or 160) volts from the main, with standard pattern instruments and Double Switch Contact Current Regulator with 30 stages	£ s. d. 24. 0. 0
Weight, net, about 70 kg; gross, about 105 kg, Packing for land transport	0.15. 0
The Switchboard carries: 1 rheostat of 36 ohms variable in 30 stages, for a max. load of 5 to 30 amps., with Double Lever Switch having 30 contacts; 2 terminals for connecting up the network; 2 fuses; 1 main switch (quick break type); 1 dead-beat standard ammeter; 2 measuring resistances; 1 ammeter switch; 1 dead-beat standard voltmeter; 1 voltmeter switch; 1 switch for the shunt for potential-distribution; 1 plug box with plug, and 4 m flexible.	
When ordering, please give network voltage. If this is not stated, the voltmeter is arranged for 125 volts.	
Fitting a Lamp Bracket for lighting purposes, with switch and 2 fuses Extra	1. 0. 0
Sliding Rheostat for fine Regulation, fitted on the panel, adaptable to 20 amps., with a resistance of nearly 0,9 ohm Extra	1. 5. 0
Resistance and Double Switch Contacts separate from the panel, and arranged so as to be portable (Fig. 50471 B) Extra	5. 0. 0
Measuring Instruments with two ranges, to admit of the measurement also of small currents and voltages Extra	2. 10. 0
The ranges are respectively 0—30 and 0—3 amps. and 0—120 and 0—12 volts, or 0—160 and 0—16 volts.	
50472. Travelling Type Experimental Switchboard (Type A₁) , Figure, with stout castors fitted to the feet, otherwise as No. 50471	26. 0. 0
Weight, net, about 87 kg; gross, about 130 kg. Packing for land transport	0. 16. 0
In ordering, the network voltage should be given. If this is not stated, the voltmeter is arranged for 125 volts.	



50471 B. 1:12.



50480. 1:18.

50473. **Experimental Switchboard, Type B₁**, for fixing to wall (cf. Fig. 50471), for connecting up to **220 volts** Direct Current, for taking currents of **0,04–20 amps.** and pressures of 0,4–220 volts from the mains, with standard pattern instruments and Double Switch Contact having 30 stages £ s. d.
24. 5. 0
Weight, net, about 82 kg; gross, about 125 kg. Packing for land transport 0. 15. 0
The switchboard carries: 1 regulating resistance of 48 ohms, variable in 30 steps, for a max. load of 5–20 amps., with Double Switch Lever having 30 contacts; 2 terminals for connecting up to the network; 2 fuses; 1 main switch (quick break type); 1 dead-beat standard ammeter; 2 measuring resistances; 1 ammeter switch; 1 dead-beat standard voltmeter; 1 voltmeter switch; 1 switch for the shunt for potential-distribution; 1 plug box with plug and 4 m flexible.
For currents to 30 amperes Extra 3. 10. 0
Fitting a Lamp Bracket for lighting purposes, with switch and 2 fuses Extra 1. 0. 0
Sliding Rheostat fitted to the slab, adaptable up to 20 amps, having a resistance of 0,9 ohm Extra 1. 5. 0
Rheostat and Double Switch Contact arranged separately from the board and made of travelling type (see Fig. 50471 B) Extra 5. 0. 0
Measuring Instruments with 2 ranges, permitting of accurately measuring small currents also Extra 2. 10. 0
The ranges are 0–30 and 0–3 amps. and 0–250 and 0–25 volts.
50474. **Travelling Type Experimental Switchboard (Type B₁)**, (cf. Fig. 50472), fitted with massive castors; apparatus and measuring instruments as in No. 50473 26. 5. 0
Weight, net, about 100 kg, gross, about 145 kg. Packing for land transport 0. 16. 0
50475. **Experimental Switchboard Type C₁**, for fixing to a wall (cf. Fig. 50471), for connecting up to **110 volts** Direct Current, and for taking currents of **0,04–20 amps.** and pressures of 0,4–110 volts from the network; with standard pattern instruments and Double Switch Contact Current Regulator with 21 stages 19. 0. 0

£ s. d.

Weight, net, about 50 kg; gross, about 75 kg. **Packing** for land transport 0. 12. 0

The switchboard carries: 1 24-ohm regulating resistance variable in 21 stages, and for a max. load of 5–20 amps., with Double Switch Contact having 21 contacts; 2 terminals for the feed supply; 2 fuses; 1 main switch (quick break type); 1 dead-beat standard ammeter; 2 measuring resistances; 1 ammeter switch; 1 dead-beat standard voltmeter; 1 voltmeter switch; 1 switch for the shunt for potential-division; 1 plug box with plug and 4 m flexible.

Fitting a Lamp Bracket for lighting purposes, with switch and 2 fuses **Extra** 1. 0. 0

Sliding Rheostat, fitted on the slab, adaptable up to 20 amps., with resistance of 0,9 ohm **Extra** 1. 5. 0

Resistance and Double Switch Contact arranged **separately** from the switchboard and made of travelling type (see Fig. 50 471 B) **Extra** 5. 0. 0

Measuring Instruments with 2 ranges, to admit also of measuring exactly small currents and pressures . . . **Extra** 2 10. 0

The ranges are 0–20 and 0–2 amps. and 0–110 and 0–11 volts.

50 476. **Travelling Type Experimental Switchboard, Type C₁** (cf. Fig. 50 472), fitted with massive castors; apparatus and instruments exactly as in No. 50 475 21. 0 0

Weight, net, about 68 kg; gross, about 100 kg. **Packing** for land transport 0.13. 0

50 480. **Travelling Type Experimental Switchboard for large Currents** (Figure), for connecting to 110 volts Direct Current, for taking currents of 0,1–150 amps. and pressures of 0,3–110 volts from the network; with Double Switch Contact Rheostat and Standard Measuring Instruments 54. 0. 0

The switchboard, together with the resistances, travels on rollers, and carries: 1 rheostat of 22 ohms, variable in 21 steps, for a maximum load of 5–150 amps.; 1 Double Switch Lever with 21 contacts; 2 fuses; 1 main switch; 1 dead-beat precision ammeter; 1 ammeter switch; 1 dead-beat precision voltmeter; 1 voltmeter switch; 1 switch for the shunt for potential-division; 2 terminals each for connecting up with the network and for the apparatus.

Direct Current Experimental Switchboards with one Circuit and with Air-damped Instruments.

50 481. **Experimental Switchboard Type A₂, Wall Pattern**, for connecting to 110–160 volts Direct Current, and for taking currents of 0,03–30 amps. and pressures of 0,3–110 (or 160) volts from the main, with air damped measuring instruments of 120 mm scale diameter, and Double Switch Contact Rheostat having 30 steps 22. 0. 0

Weight, net, about 70 kg; gross, about 105 kg. **Packing** for land transport 0. 14. 0

The switchboard carries: 1 36-ohm Rheostat variable in 30 steps and for a max. load of 5 to 30 amps., with Double Switch Lever having 30 contacts; 2 terminals for connecting to network; 2 fuses; 1 main switch (quick break); 1 ammeter; 1 voltmeter; 1 voltmeter switch; 1 switch for the shunt for obtaining division of potential; 1 plug box with plug and 4 m flexible.

Sliding Rheostat for fine regulation, fitted on switchboard, adaptable for up to 20 amps., having resistance of 0,9 ohm **Extra** 1. 5. 0

50 482. **Portable Experimental Switchboard Type A₂**, resting on stout rollers, apparatus and instruments exactly as in Switchboard 50 481 24. 0. 0

Weight, net, about 87 kg; gross, about 130 kg. **Packing** for land transport 0. 15. 0

50 483. **Experimental Switchboard, Type B₂, Wall Pattern**, for connecting to 220 volts Direct Current; for taking currents of 0,04–20 amps. and pressures of 0,4–220 volts from the network, with air-damped instruments of 120 mm scale diameter and Double Switch Contact Rheostat having 30 stages 22. 5. 0

Weight, net, about 82 kg; gross, about 125 kg. **Packing** for land transport 0. 14. 0

The switchboard carries: 1 48-ohm Rheostat variable in 30 steps and for a max. load of 5 to 20 amps., with Double Switch Lever with 30 contacts; 2 terminals for connecting up to network; 2 fuses; 1 main switch (quick break); 1 ammeter; 1 voltmeter; 1 voltmeter switch; 1 switch for the shunt for obtaining division of potential; 1 plug box with plug and 4 m flexible.

For Currents to 30 amperes **Extra** 3. 10. 0

50 484. **Portable Experimental Switchboard Type B₂** resting on stout rollers; apparatus and instruments exactly as in Switchboard 50 483 24. 5. 0

Weight, net, about 100 kg; gross, about 150 kg. **Packing** for land transport 0. 15. 0

- 50 485. **Experimental Switchboard Type C₂, Wall Pattern**, for connecting up to **110 volts** Direct Current, for taking currents of **0,04—20 amps.** and pressures of 0,4—110 volts from the network; with air-damped instruments of 120 mm scale diameter and with Double Switch Contact Rheostat having 21 stages £ s. d.
17. 10. 0

Weight, net, about 50 kg; gross, about 76 kg. **Packing** for land transport 0. 12 0

The switchboard contains: 1 24-ohm Rheostat variable in 21 steps and for a max. load of from 5—20 amps., with Double Switch Lever having 21 contacts; 2 terminals for connecting up to the main; 2 fuses; 1 main switch (quick break); 1 ammeter; 1 voltmeter; 1 voltmeter switch; 1 switch for the shunt for obtaining division of potential; plug box with plug and 4 m flexible.

Direct Current Experimental Switchboard with two Circuits for Equal Currents, and with Standard Type Instruments.

- 50 490. **Experimental Switchboard with 2 Circuits, Wall Pattern, Type D₁, Figure**, for connecting up to **110—160 volts** Direct Current, and for taking currents of **0,03—30 amps.** and pressures of 0,3—110 (or 160) volts in each of the two circuits, with Standard Instruments and Double Switch Contact Rheostat having 30 stages 41. 0. 0

The switchboard contains in each of the two circuits: 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 ammeter switch; 1 switch for the shunt for obtaining potential-division; 1 36-ohm regulating resistance variable in 30 steps; for a max. load of 5—30 amps.; 1 Double Switch Lever with 30 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting the switchboard to the network. The board also contains for the two circuits in common: 1 dead-beat precision voltmeter and 1 voltmeter switch for 4 circuits.

Fitting a Lamp Bracket for lighting purposes, with switch and 2 fuses **Extra** 1. 0. 0

Sliding Rheostat for fine regulation, fitted to the board, adaptable for up to 20 amps., having a resistance of about 0,9 ohm **Extra for the 2 circuits** 2. 10. 0

Measuring Instruments with 2 ranges, from 0—30 and 0—3 amps. respectively and 0—120 and 0—12 volts, or 0—160 and 0—16 volts **Extra** 3. 15. 0

- 50 491. **Travelling Type Experimental Switchboard with 2 Circuits (Type D₁)**, cf. Fig. 50 472, resting on massive castors; apparatus and instruments exactly as in No. 50 490 43. 10. 0

- 50 492. **Experimental Switchboard with 2 Circuits, Wall Pattern (Type E₁)**, Fig. 50 490, for connecting up to **220 volts** Direct Current, and for taking currents of **0,04—20 amps.** and pressures of 0,4—220 volts in each of the circuits; with Standard Instruments and Double Switch Contact Rheostat with 30 stages 41. 10. 0

The switchboard contains in each of the two circuits: 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 ammeter switch; 1 48-ohm rheostat variable in 30 steps, and for max. load of 5 to 20 amps.; 1 Double Lever Switch with 30 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting the switchboard to the network. The board also has for the two circuits in common: 1 dead-beat precision voltmeter and 1 voltmeter switch for 4 circuits.

Sliding Rheostat for fine regulation, fitted to the board, adaptable for up to 20 amps., and having a resistance of about 0,9 ohm **Extra for the 2 circuits** 2. 10. 0

Fitting a Lamp Bracket for lighting purposes, with switch and 2 fuses **Extra** 1. 0. 0

Measuring Instruments with 2 Ranges, from 0—30 and 0—3 amps. and 0—220 and 0—22 volts **Extra** 3. 15. 0

- 50 493. **Travelling Type Experimental Switchboard with 2 Circuits, Type E₁** (cf. Fig. 50 472), resting on stout castors; apparatus and instruments exactly as in Nr. 50 492 44. 0. 0

- 50 494. **Experimental Switchboard with 2 Circuits, Type F₁ (Wall Pattern)**, cf. Fig. 50 490, for connecting up to **110 volts** Direct Current, and for taking currents of **0,04—20 amps.** and pressures of 0,4—110 volts in each circuit; with Standard Instruments and two Double Switch Contact Rheostats with 21 steps 29. 0. 0

The switchboard contains in each of the two circuits: 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 ammeter switch; 1 switch for the shunt; 1 24-ohm Rheostat variable in 21 stages and for a max. load of 5—20 amps.; 1 Double Switch Lever with 21 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting the switchboard to the network. The board also has for the two circuits in common: 1 dead-beat standard voltmeter and 1 voltmeter switch for 4 circuits.

Fitting a Lamp Bracket for lighting purposes, with switch and 2 fuses **Extra** 1. 0. 0

Sliding Rheostat for fine regulation, fitted to the board, adaptable for up to 20 amps., and having a resistance of about 0,9 ohm **Extra for the 2 circuits** 2. 10. 0

Measuring Instruments with 2 Ranges, from 0—30 and 0—3 amps. and 0—120 and 0—12 volts **Extra** 3. 15. 0

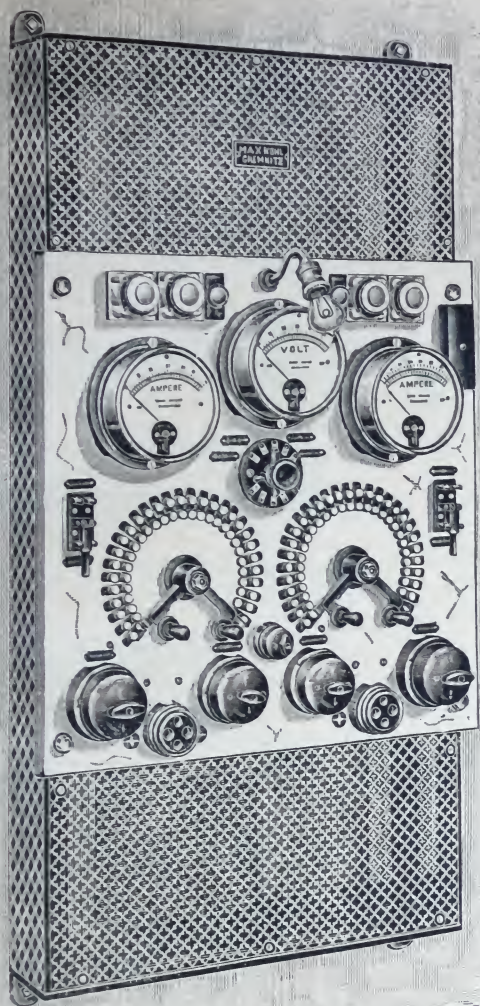
- 50 495. **Travelling Type Experimental Switchboard with 2 Circuits (Type F₁)**, cf. Fig. 50 472, resting on stout castors; apparatus and instruments exactly as in No. 50 494 31. 10. 0

Direct Current Experimental Switchboards with two Circuits for Equal Currents, and with Air-damped Measuring Instruments.

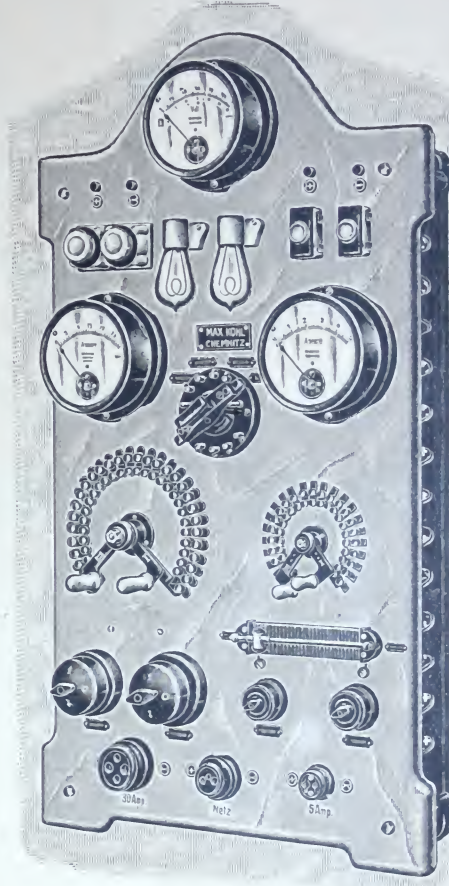
50 496. Experimental Switchboard with 2 Circuits, Type D₂ (Wall Pattern) , cf. Fig. 50 490, for connecting up to 110—160 volts Direct Current, and for taking currents of 0,03 to 30 amps. and pressures of 0,3—110 (or 160) volts in each of the two circuits; with air-damped measuring instruments having a scale-diameter of 120 mm and two Double Switch Contact Rheostats with 30 stages	£ s. d. 38. 0. 0
The switchboard contains in each circuit: 2 fuses; 1 main switch; 1 ammeter; 1 switch for the shunt for division of potential; 1 36-ohm Rheostat variable in 30 steps, for 5—30 amps. max. load; 1 Double Switch Lever with 30 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting the switchboard to the network. The board also has in common for the two circuits: 1 voltmeter and 1 voltmeter switch for 4 circuits.	
Sliding Rheostat for fine regulation, fitted to the switchboard, adaptable for up to 20 amps., and having a resistance of about 0,9 ohm Extra for both circuits	2. 10. 0
50 497. Travelling Type Experimental Switchboard, Type D₂ (cf. Fig. 50 472), resting on massive castors; apparatus and instruments exactly as in No. 50 496	40. 10. 0
50 498. Travelling Type Experimental Switchboard, Type E₂ (cf. Fig. 50 490), for connecting up to 220 volts Direct Current, and for taking currents of 0,04—20 amps. and pressures of 0,4—220 volts in each of the two circuits; with air-damped measuring instruments of 120 mm scale-diameter and two Double Switch Contact Rheostats with 30 stages	38. 10. 0
The switchboard contains in each circuit: 2 fuses; 1 main switch; 1 ammeter; 1 switch for the shunt for obtaining division of potential; 1 48-ohm rheostat variable in 30 steps and for 5—20 amps. max. load; 1 Double Switch Lever with 30 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting the switchboard to the network. The board has in common for both circuits: 1 voltmeter and 1 voltmeter switch for 4 circuits.	
Sliding Rheostat for fine regulation, fitted to the switchboard, adaptable for up to 20 amps. and having a resistance of about 0,9 Ohm Extra for both circuits	2. 10. 0
50 499. Travelling Type Experimental Switchboard with 2 Circuits, Type E₂ (cf. Fig. 50 472), resting on stout castors; apparatus and instruments exactly as in No. 50 498	41. 0. 0
50 500 Experimental Switchboard with 2 Circuits, Type F₂, Wall Pattern , for connecting up to 110 volts Direct Current, for taking currents of 0,04—20 amps. and pressures of 0,4—110 volts in each of the two circuits, with air-damped measuring instruments of 120 mm scale-diameter and two Double Switch Contact Rheostats with 21 steps	26. 0. 0
The switchboard contains in each circuit: 2 fuses; 1 main switch; 1 ammeter; 1 switch for the shunt for obtaining division of potential; 1 24-ohm Rheostat variable in 21 stages and for 5—20 amps. max. load; 1 Double Switch Lever with 21 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting the board to the network. In addition there are for the two circuits in common; 1 voltmeter and 1 voltmeter switch for 4 circuits.	
50 501. Travelling Type Experimental Switchboard with 2 Circuits, Type F₂ (cf. Fig. 50 472), resting on stout castors; apparatus and instruments exactly as in No. 50 500	28. 10. 0

Direct Current Experimental Switchboards with two Circuits of different Current-density, with Standard Type Instruments.

50 502. Experimental Switchboard, Type G₁, Wall Pattern , (Figure), with 2 circuits for currents of different strength, for connecting up to 110—160 volts Direct Current, and for taking currents of 0,03—30 amps. and pressures of 0,3—110 (or 160) volts from one circuit, and currents of 0,01—5 amps. and pressures of 0,3—110 (or 160) volts from the other circuit, with Standard Instruments and two Double Switch Contacts with 30 and 21 stages respectively	36. 0. 0
In ordering, please state pressure of network. If this is not given, the voltmeter is supplied for 125 volts.	
Weight , net, about 120 kg; gross, about 175 kg. Packing for land transport	1. 2. 0
The switchboard contains for the 30 ampere circuit : 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 switch for the shunt for obtaining division of potential; 1 36-ohm Rheostat variable in 30 steps, for a max. load of 5—30 amps.; 1 Double Switch Lever with 30 contacts; 1 check lamp; 1 plug box with plug and 4 m flexible; 2 terminals for connecting up to the network.	



50490. 1:12.



50502. 1:10.

For the 5-ampere circuit the switchboard contains: 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 switch for the shunt for obtaining division of potential; 1 36-ohm Rheostat variable in 21 steps, for a max. load of 5 amps.; 1 Double Switch Lever with 21 contacts; 1 sliding rheostat for fine regulation; 1 plug box with plug and 4 m flexible; 2 terminals for connecting to the network.

The following are for both circuits in common: 1 dead-beat standard voltmeter; 1 voltmeter switch for 4 circuits; 1 double-pole plug box (with fuse) for 6 amps. for connecting up lamps for lighting or the like.

Two-range Measuring Instruments Extra £ s. d. 3. 15. 0

50502 a. Travelling Type Experimental Switchboard, Type G₁, with two circuits for different Current-strengths (cf. Fig. 50472); switches and instruments as in No. 50502 38. 10. 0

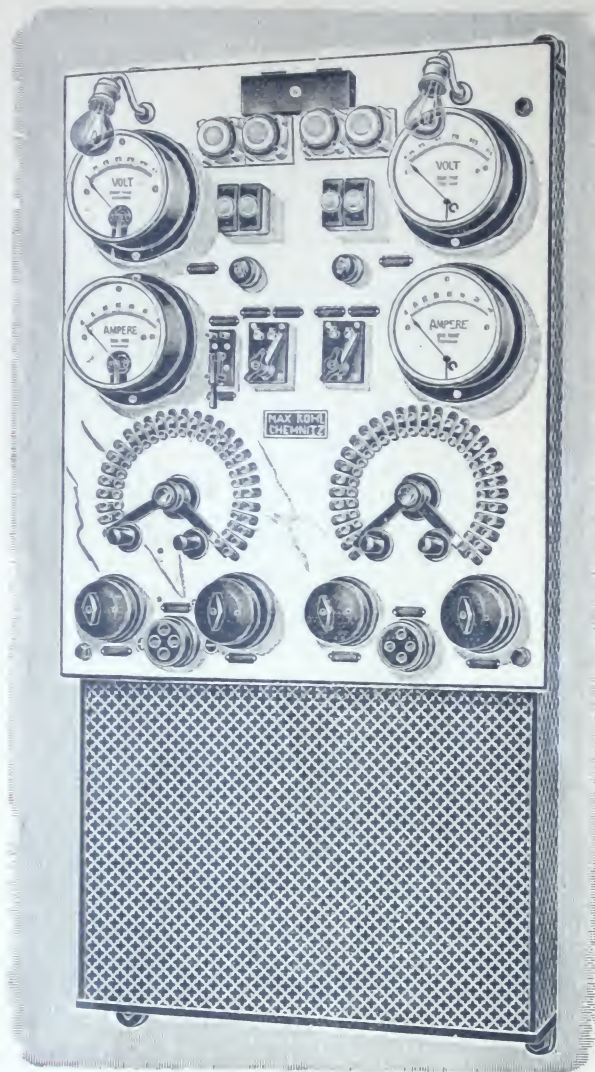
Weight, net, about 130 kg; gross, about 190 kg. Packing for land transport 1. 3. 0

50502 b. Experimental Switchboard, Type H₁, Wall Pattern (cf. Fig. 50502), with two Circuits for different Current-strengths, for connecting up to 220 volts Direct Current, and for taking currents of 0,04—20 amps. and pressures of 0,4—220 volts from one circuit and currents of 0,01—4 amps. and pressures of 0,4—220 volts from the other circuit; with Standard Instruments and two Double Switch Contacts with 30 and 21 stages respectively 36. 10. 0

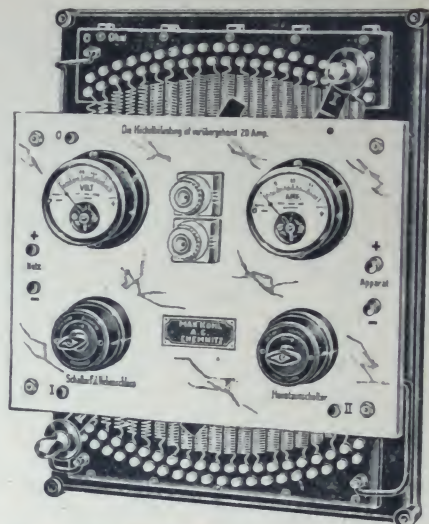
Weight, net, about 120 kg; gross, about 175 kg. Packing for land transport 1. 2. 0

The switchboard contains for the 20-ampere circuit: 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 switch for the shunt for obtaining division of potential; 1 48-ohm Rheostat variable in 30 steps, for a max. load of 5—20 amps.; 1 Double Switch Lever with 30 contacts; 1 plug box with plug and 4 m flexible; 2 terminals for connecting up to the network.

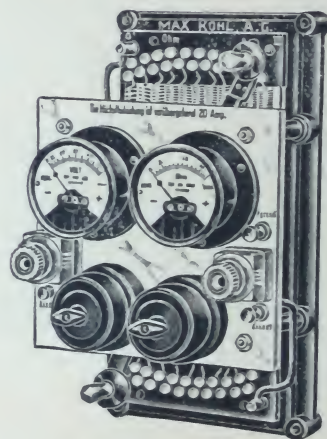
The circuit to 4 amperes contains: 2 fuses; 1 main switch; 1 dead-beat standard ammeter; 1 switch for the shunt for obtaining division of potential; 1 60-ohm Rheostat variable in 21 steps, for a max. load of 4 amps.; 1 Double Switch Lever with 21 contacts; 1 sliding rheostat for fine regulation; 1 plug box with plug and 4 m flexible; 2 terminals for connecting up to the network.



50 509 1:12.



82 095, 82 096, 82 098, 82 099. 1:10.



82 097, 82 100. 1:9.

The following are provided for both circuits in common: 1 dead-beat standard voltmeter; 1 voltmeter-switch for 4 circuits; 1 double-pole switch (with fuse) for 6 amps. for connecting up lamps for lighting purposes or the like.

£ s. d

Double-range Measuring Instruments	Extra	3. 15. 0
50 502 c. Travelling Type Experimental Switchboard, Type H ₁ , with two Circuits of different Current-strength (cf. Fig. 50 472); switches and instruments as in No. 50 502 b		39. 10. 0
Weight, net, about 130 kg; gross, about 190 kg. Packing for land transport		1. 4. 0

Experimental Switchboard for two kinds of Current.

50 509. Experimental Switchboard, Wall Pattern, with 2 Circuits, for connecting up simultaneously to a Direct and an Alternating Current Supply, having a voltage of 110 to 160 volts, for taking currents of 0.3—30 amps. and pressures of 0.3—110 (or 160) volts, Figure		13. 0. 0
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The switchboard is equipped for Direct and for Alternating Current with the following: 1 Rheostat each of 36 ohms, variable in 30 stages and for a max. load of 5—30 amps.; each 1 Double Switch Lever with 30 contacts; each 2 fuses; each 1 main switch; each 2 terminals for connecting up to the supply lead; also each 1 switch for the shunt; each 1 plug box with plug and 4 m flexible; each 1 glow lamp bracket with switch and 2 fuses. In addition, for Direct Current: 1 dead-beat standard ammeter, 1 ammeter switch; 1 dead-beat precision voltmeter and 1 voltmeter switch; for Alternating Current: with 1 ammeter, 1 voltmeter and 1 voltmeter switch.

Simple Experimental Switchboards.

£ s. d.

In addition to being makers of the most complete patterns of experimental switchboards, we also manufacture those of a lighter and simpler pattern, which, however, permit of being used in a multiplicity of ways.

The construction of the switchboards may be seen on reference to Figs. 82095 and 82097. A marble slab is placed on one of the Double Switch Contact Resistances described later on, this slab containing the necessary fuses, switches and measuring instruments. The method of connecting is generally in accordance with that described on pp. 1318 and 1319, with the exception that the measuring instruments cannot be commutated, and that they give the voltage and current in the apparatus direct.

The switchboards are designed for fixing on the wall. Directions for use and a diagram of connections are appended to each switchboard.

The metering instruments have an approx. base diameter of 130 mm.

82095. **Simple Experimental Switchboard, Type EA₁**, for connecting up to **110 volts D. C.**, Figure, with Double Switch Contact Resistance, **39 contacts**, 36 ohms; max. permissible load **5 to 30 amps.** according to position of Switch Contacts; for taking currents of **0,03 to 30 amps.** and pressures of **0,3 to 110 volts** from the supply; with Precision Instruments 13. 0. 0

The marble slab contains: 2 terminals for the supply current; 2 fuses; 1 main switch; 1 switch for the shunt; 1 Precision Ammeter; 1 Precision Voltmeter; 2 terminals for connecting up the apparatus.

82096. — idem, **Type EB₁**, Figure, style as No. 82095, but for connecting up to **220 volts D. C.**, with 2 Switch Contacts, **39 contacts**, 48 ohms; max. permissible load, **5 to 20 amps.** according to position of switch contacts; for taking currents of **0,08 to 20 amps.** and pressures of **0,8 to 220 volts** from the supply 13. 5. 0

82097. — idem, **Type EC₁**, Figure, Fittings as No. 82095, for connecting up to **110 volts D. C.**, with Double Switch Contact Resistance, **21 contacts**, 24 ohms; max. permissible load, **5 to 20 amps.** according to position of switch contacts; for taking currents of **0,08 to 20 amps.** and pressures of **0,8 to 110 volts** from the supply 10. 5. 0

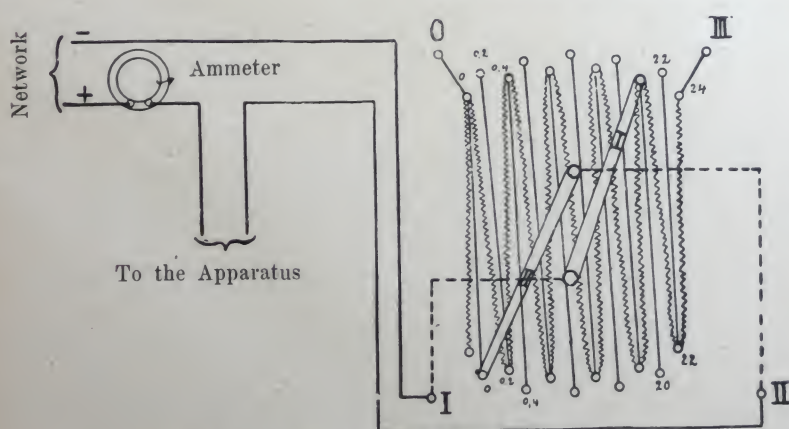
82098. **Simple Experimental Switchboard, Type EA₂**, Figure, fittings and load-limits as No. 82095, but with **electromagnetic Measuring Instruments**, can be used for D. C. and A. C. 11. 15. 0

82099. — idem, **Type EB₂**, Figure, fittings and load-limits as No. 82096, but with **electromagnetic Measuring Instruments**, can be used for D. C. and A. C. 12. 0. 0

82100. — idem, **Type EC₂**, Figure, fittings and load-limits as No. 82097, but with **electromagnetic Measuring Instruments**, can be used for D. C. or A. C. 9. 0. 0

The remarks apply for temporary loading. When ordering, kindly state precisely the network voltage, and, in the case of A. C., the frequency.

Experimental Resistances with 2 Switch Contacts, as suggested by Prof. Dr. W. Brüsch, Lübeck, constructed by Max Kohl, Ltd., Chemnitz.



I. Grouping as a Series Resistance. Fig. 1.

We have, at the instigation of Prof. Dr. W. Brüsch of Lübeck, constructed the Experimental Resistances with 2 Switch Contacts, described below. This type of resistance admits of a variety of adaptations, being particularly suitable for taking from heavy current supplies any large or small currents at low terminal voltage.

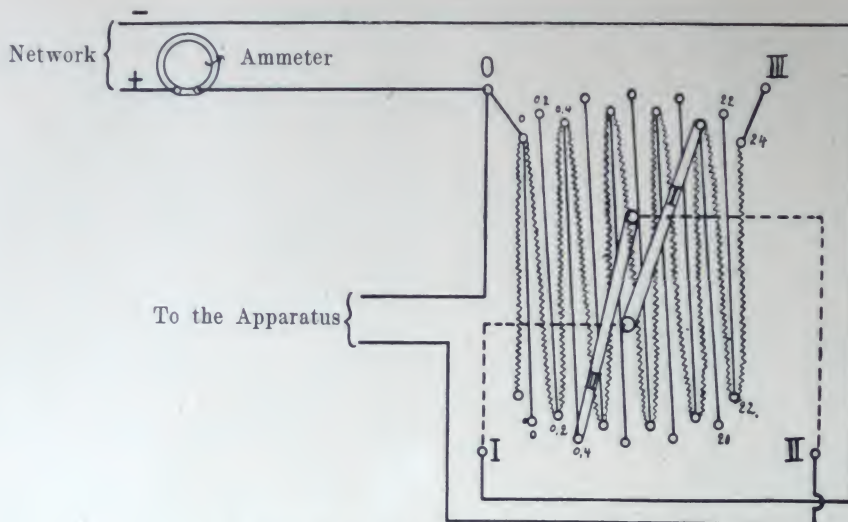
The resistances can be used in three different manners.

Grouping No. I.

As a Series Resistance, Figure 1.

This method of using the resistances can be recommended in the case of apparatus where there is no interruption of the current, for taking heavy currents where the terminal voltage at the apparatus is fairly high (e. g., for working an

arc lamp). Coarse regulation is obtained by Switch Contact No. I, while finer steps can be had by employing No. II.



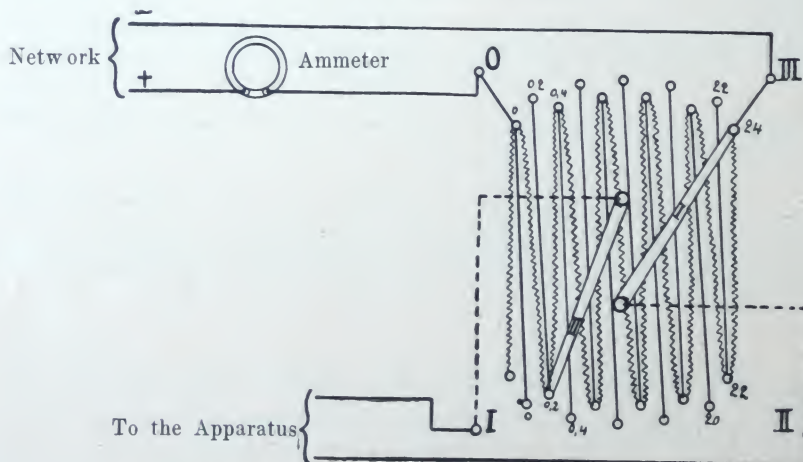
II. Grouping as a Shunt Resistance. Fig. 2.

Grouping No. II.

As a Shunt Resistance, Figure 2, for taking off any Currents (within the limits of load) at low Pressure.

It is advisable first of all to place Switch Contact *I* on the highest resistance-value and Contact *II* on "O", the latter being moved forward until the desired current-density is reached.

If Switch Contact *II* is still near to "O" and should a further slight increase in the current still be necessary, it is better to move Switch Handle *I* back than No. *II* forward. In feeding apparatus which work with an interrupted current (e. g. induction coils with platinum interrupters) too high a tension should not predominate when the current is admitted otherwise there is danger of the contacts getting burned. When heavy currents are being used, Switch Contact No. *II* should be left near to O and Contact *I* moved back cautiously. The pressure at the apparatus when the current is being admitted is to the working voltage as the resistance-values given alongside the contact studs on which the Handles are placed are to each other. The maximum permissible currents given under (1) should in no case be exceeded.



III. Grouping as Shunt Resistance for small currents. Fig. 3.

Grouping No. III.

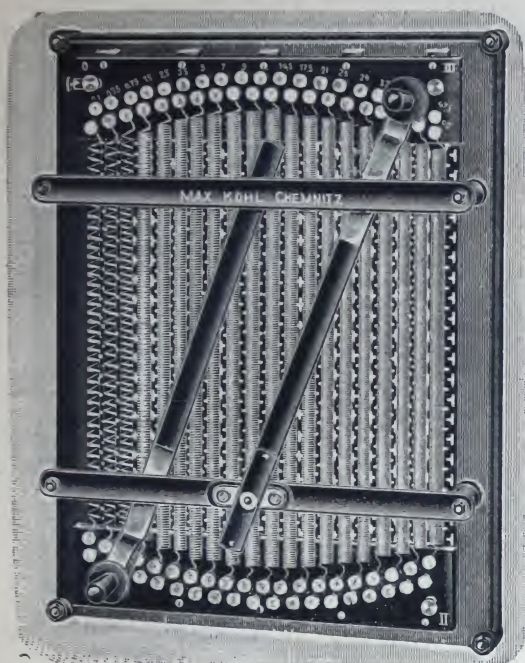
As a Shunt Resistance, Figure 3, for taking off small Currents up to 2 Amps.

As a rule both Switch Contact Handles are first of all placed on the zero contacts, the current in the apparatus being slowly increased by adjusting one of the Contact Handles.

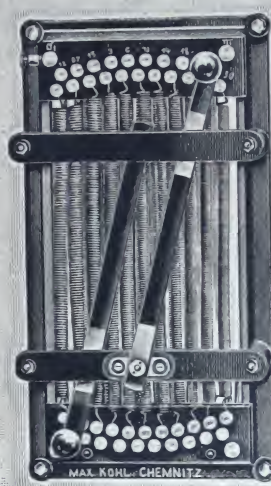
If Handle No. *II* is placed on the spot where No. *I* previously stood, and *vice-versa*, this changes the poles at the apparatus.

Under no circumstances whatever must this method of grouping be used for taking off higher current-densities than 2 Amps. A too heavy current — with consequent burning out of the resistances — is particularly liable to take place when one Handle is near the highest resistance-value and the other close to the zero-value and the resistance of the apparatus itself is small. The latter would cause most of the spirals to short-circuit and the thin spirals, in series, near to the maximum resistance-value would then be charged with a current exceeding that prescribed.

It is always advisable (as also in the case of other methods of employing the resistances) to connect up a reliable ammeter for protecting the resistance and the apparatus connected up. The total current flowing through the resistance, when connected up in accordance with Scheme No. *III*, should not exceed 5 Amps.



50516/17. 1:10.



50518. 1:9.

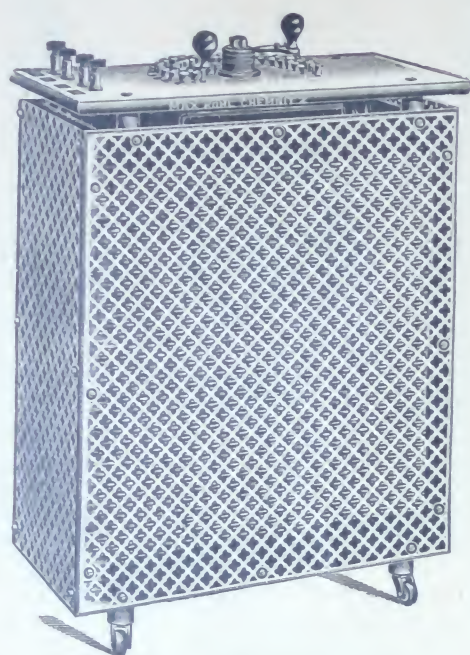


50510, 50512. 1:14.

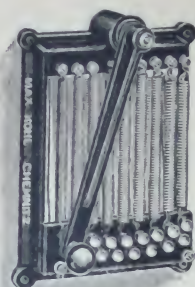
50516. Experimental Resistance, Type A , Figure, with 2 switch handles, 39 contacts; resistance 36 ohms; maximum permissible load, 5 to 30 amps., according to position of contact handles; for taking currents of 0,03 to 30 amps. and pressures of 0,3 to 110 volts from the supply line	£ s. d. 6. 15. 0
50517. Experimental Resistance, Type B , Figure, with 2 switch handles, 39 contacts; resistance 48 ohms; maximum permissible load 5 to 20 amps., according to the position of the switch handles; for taking currents of 0,08 to 20 amps. and pressures of 0,8 to 220 volts from the supply line	6. 15. 0
50518. Experimental Resistance, Type C , Figure, with 2 switch handles, 39 contacts; resistance 24 ohms; maximum permissible load, 5 to 20 amps., according to the position of the switch handles; for taking currents of 0,08 to 20 amps. and pressures of 0,8 to 110 volts from the supply line	4. 10. 0

Rheostats.

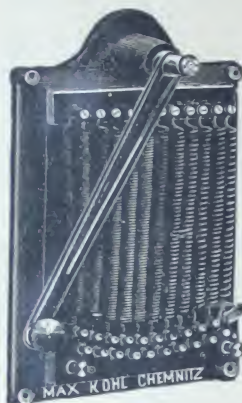
50510. Double Switch Contact Rheostat, Wall Type , Figure, for connecting up to 110 to 160 volts working pressure, without measuring instruments and switchgear, with regulating resistance of 36 ohms, variable in 30 steps, for 5—30 amps. maximum load; can be employed either as a series resistance or shunt resistance for division of potential	14. 0. 0
50511. — The preceding, table form , travelling on rollers, Figure on page 1330	15. 0. 0
50512. Double Switch Contact Rheostat, Wall Pattern , Figure, for connecting up to a working pressure of 220 volts; without measuring instruments and switchgear; with regulating resistance of 48 ohms, variable in 30 steps, for 5—20 amperes maximum load; can be used either as a series resistance or a shunt resistance for potential-division	14. 0. 0



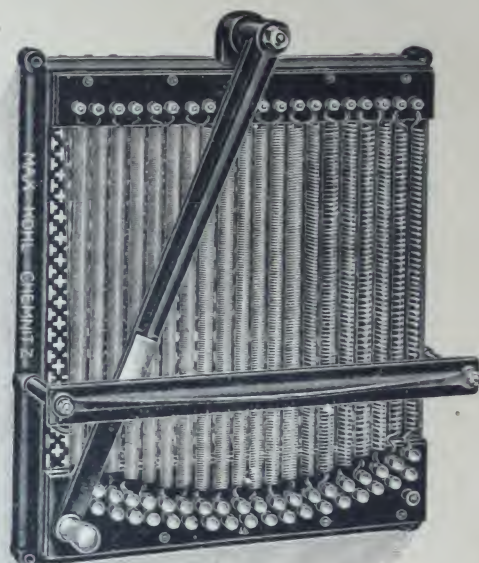
50 511, 50 513, 50 515. 1:10.



50 519. 1:9.



50 520. 1:9.

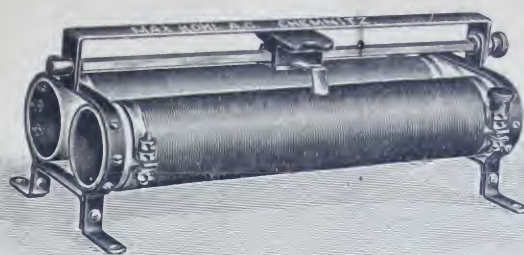


50 522. 1:9.

50 513. Double Switch Contact Rheostat, Table Pattern , travelling on rollers, Figure, for connecting up to a working pressure of 220 volts ; without measuring instruments and switchgear; with regulating resistance of 48 ohms, variable in 30 steps, for 5—20 amperes maximum load; can be used either as a series resistance or a shunt resistance for potential-division	£ s. d.
	15. 0. 0
50 514. Double Switch Contact Rheostat, Wall Pattern , cf. Figure 50 510, for connecting up to 110 volts working pressure, without measuring instruments and switchgear; with 24 ohm regulating resistance variable in 21 steps, for a max. load of 5—20 amps.; can be employed either as a series resistance or as a shunt resistance for division of potential	10. 10. 0
50 515. — The preceding, Table Type , travelling on rollers, Figure	11. 10. 0
50 519. Rheostat with 17 contacts, Figure, 20 ohms resistance, for a max. load of 2—15 amps. , in iron frame, for fixing to the wall	1. 15. 0
50 520. — The preceding, larger , Figure, with 21 contacts, 25 ohms resistance, for 2—20 amps. max. load	2. 5. 0
50 521. — The preceding, with 21 contacts, 30 ohms resistance, for 2—25 amps. max. load	2. 15. 0
50 522. — The preceding, larger , with 38 contacts, Figure, 50 ohms resistance, for 2—20 amps. max. load	4. 5. 0



82137. 1:6.



82185. 1:6.

Sliding Resistances.

Sliding Resistances, Figure, for table use and for firmly fixing, of constantan wire wound on an insulating weldless steel tube, enamelled.

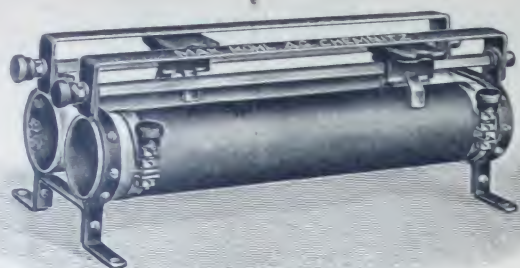
Max. load	Model A ₁				Model B ₁				Model C ₁				Model D ₁				Model E ₁				Model F ₁			
	Diam 30 mm Length 130 mm				Diam. 35 mm Length 170 mm				Diam. 40 mm Length 210 mm				Diam. 50 mm Length 310 mm				Diam. 55 mm Length 410 mm				Diam. 60 mm Length 460 mm			
Amp.	Ohms	List No.	s. d.		Ohms	List No.	s. d.		Ohms	List No.	s. d.		Ohms	List No.	s. d.		Ohms	List No.	s. d.		Ohms	List No.	s. d.	
0,3	670	82101	6.8		1130	82113	7.9		1680	82125	9.4		3340	82137	11.3		5020	82149	14.9		6230	82161	18.11	
0,6	200	82102	6.8		330	82114	7.9		480	82126	9.4		950	82138	11.3		1450	82150	14.9		1800	82162	18.11	
1,0	125	82103	6.8		210	82115	7.9		310	82127	9.4		600	82139	11.3		930	82151	14.9		1100	82163	18.11	
1,5	42	82104	6.8		70	82116	7.9		110	82128	9.4		200	82140	11.3		325	82152	14.9		390	82164	18.11	
2,0	24	82105	6.8		40	82117	7.9		60	82129	9.4		110	82141	11.3		180	82153	14.9		225	82165	18.11	
3,0	19	82106	6.8		32	82118	7.9		48	82130	9.4		90	82142	11.3		145	82154	14.9		175	82166	18.11	
4,0	11	82107	7.0		17	82119	8.6		25	82131	10.0		45	82143	13.6		75	82155	18.6		95	82167	24.9	
5,0	5	82108	7.0		8	82120	8.6		13	82132	10.0		24	82144	13.6		38	82156	18.6		48	82168	24.9	
6,0	3	82109	7.0		5	82121	8.6		7,5	82133	10.0		14	82145	13.6		20	82157	18.6		28	82169	24.9	
7,0	2	82110	7.0		3	82122	8.6		5	82134	10.0		9,5	82146	13.6		15	82158	18.6		18	82170	24.9	
8,0	1,6	82111	7.0		2,5	82123	8.6		4	82135	10.0		7,5	82147	13.6		12	82159	18.6		14	82171	24.9	
9,0	0,7	82112	7.0		1	82124	8.6		1,5	82136	10.0		3	82148	13.6		4,9	82160	18.6		6	82172	24.9	

If specially ordered, all the above listed Resistances can be supplied without sliding bar and sliding brush, but with feet for using as fixed series resistances. In this case the prices are decreased by

	in Model A ₁	Model B ₁	Model C ₁	Model D ₁	Model E ₁	Model F ₁
About £	0.1.6	0.2.0	0.2.6	0.3.0	0.3.6	0.4.0

Double Sliding Resistances, Figure, consisting of 2 sliding resistances as above, which can be put in series or parallel.

Max. Load in		Resistance in		Model G ₁		Resistance in		Model H ₁		Resistance in		Model J ₁		Resistance in		Model K ₁	
Series	Parallel	Series	Parallel	Length 210 mm		Series	Parallel	Length 310 mm		Series	Parallel	Length 410 mm		Series	Parallel	Length 460 mm	
Amperes				List No.	s. d.	Ohms		List No.	s. d.	Ohms		List No.	s. d.	Ohms		List No.	s. d.
0,3	0,6	3360	840	82173	18.11	6680	1670	82185	23.2	10040	2510	82197	30.0	12460	3115	82209	38.6
0,6	1,2	960	240	82174	18.11	1900	475	82186	23.2	2900	725	82198	30.0	3600	900	82210	38.6
1,0	2,0	620	155	82175	18.11	1200	300	82187	23.2	1860	465	82199	30.0	2200	550	82211	38.6
1,5	3,0	220	55	82176	18.11	400	100	82188	23.2	650	162,5	82200	30.0	780	195	82212	38.6
2,0	4,0	120	30	82177	18.11	220	55	82189	23.2	360	90	82201	30.0	450	112,5	82213	38.6
3,0	6,0	96	24	82178	18.11	180	45	82190	23.2	290	72,5	82202	30.0	350	87,5	82214	38.6
4,0	8,0	50	12,5	82179	20.5	90	22,5	82191	27.9	150	37,5	82203	38.6	190	47,5	82215	50.0
5,0	10,0	26	6,5	82180	20.5	48	12	82192	27.9	76	19	82204	38.6	96	24,0	82216	50.0
6,0	12,0	15	3,75	82181	20.5	28	7	82193	27.9	40	10	82205	38.6	56	14,0	82217	50.0
7,0	14,0	10	2,50	82182	20.5	19	4,75	82194	27.9	30	7,5	82206	38.6	36	9	82218	50.0
8,0	16,0	8	2,0	82183	20.5	15	3,75	82195	27.9	24	6	82207	38.6	28	7	82219	50.0
9,0	18,0	3	0,75	82184	20.5	6	1,5	82196	27.9	9,8	2,45	82208	38.6	12	3	82220	50.0



82 225. 1:6.



82 229. 1:5.

Universal Sliding Resistances, Figure, comprising a combination of 2 sliding resistances whose resistances are of different magnitude and varying loading capacity, it being possible to use these as required in series, parallel, or singly by means of a connecting strap. An extremely complete range of fine adjustment of the current-value to be regulated is possible with these resistances and in consequence they can be highly recommended both for this reason and by virtue of their many-sided uses for practical and scientific purposes.

Max. Load	Model L ₁ Length 210 mm			Model M ₁ Length 310 mm			Model N ₁ Length 410 mm			Model O ₁ Length 460 mm		
Amps.	Ohms	List No.	s. d.	Ohms	List No.	s. d.	Ohms	List No.	s. d.	Ohms	List No.	s. d.
0.3	1680	82 221	21. 8	3340	82 225	26. 0	5020	82 229	33. 0	6230	82 233	42. 0
1.5	110			200			325			390		
1.0	310	82 222	22. 4	600	82 226	28. 6	930	82 230	37. 0	1100	82 234	47. 0
4.0	25			45			75			95		
2.0	60	82 223	22. 4	110	82 227	28. 6	180	82 231	37. 0	225	82 235	47. 0
7.0	5			9.5			15			18		
4.0	25	82 224	23. 0	45	82 228	31. 0	75	82 232	41. 0	95	82 236	53. 0
9.0	1.5			3			4.9			6		

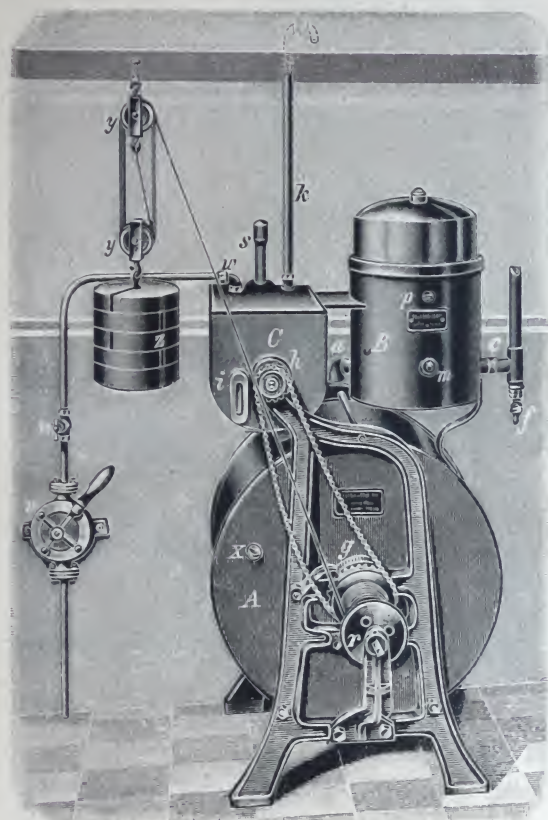
The Constant Load with maximum current applies when the Sliding Resistances are arranged vertically.

Covering of the resistances with perforated sheet increases the price

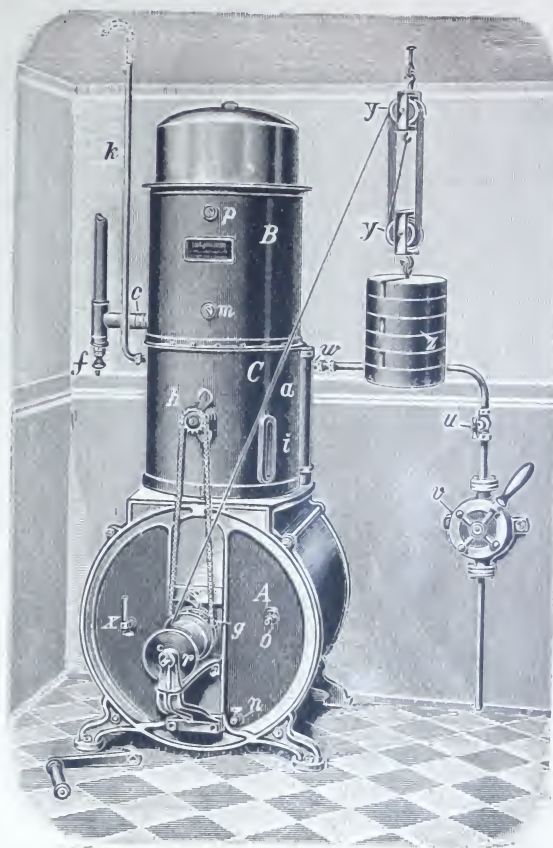
for Model: A₁ B₁ C₁ D₁ E₁ F₁ G₁ H₁ J₁ K₁ L₁ M₁ N₁ O₁
by £ 0.2.6 0.3.0 0.3.6 0.4.6 0.5.6 0.7.0 0.6.0 0.7.0 0.8.0 0.9.0 0.6.0 0.7.0 0.8.0 0.9.0

Resistances with other dimensions, values of resistance, capacities are supplied at special prices.

Gas Generating Apparatus.



Model "Gnom".



Model Size 1-6.

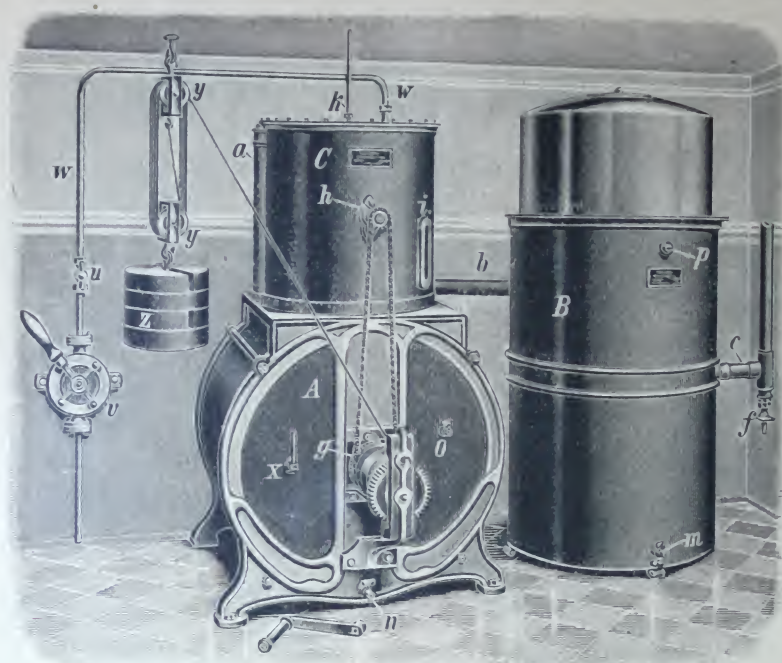
Herbst Air-Gas Generator.

The apparatus are producing gas for lighting, heating and power; very little attention required; gas always ready for use, being generated in accordance with the supply needed. The gasoline (also called **hydrine, soline** or **hexane**) is a petroleum distillate and consists of light hydro-carbons; Gasoline is a Gas formed for the greater part of air, it is non-poisonous, makes itself felt when interruptions occur by a smell which is not unpleasant; and danger of explosion is reduced to a minimum especially when compared with coal gas, acetylene, etc.

Air-Gas Generator "Gnom".

List No.	Size	Output in cubic-meters per hour (1 m ³ = 1000 l)	Bunsen or Teclu burners	Weight required	Prices £
82 237	"Gnom" 0	2	8 pieces	140 kg	30. 0. 0
82 238	"Gnom" 1	2,5	10 pieces	150 kg	32. 10. 0
82 239	"Gnom" 2	3,5	14 pieces	200 kg	35. 0. 0
82 240	"Gnom" 3	4,5	18 pieces	250 kg	37. 10. 0

The gas apparatus, Figure, comprises the air bellows with carburetter A, the gasometer B and the gasoline tank C. A suction cylinder in the bellows A, is set in motion by any convenient source of power (as a rule by a driving weight z), sucks air through an orifice in the back wall of the bellows, and forces the same at a certain pressure through a pipe line into the gasometer. The gasoline flows from the tank C through a thin line of piping t, into the carburetter, the quantity being regulated to the consumption by an exhaustor arrangement. The gas mixture generated contains only 1 kg gasoline in 5000 litres of air. The only attention which it is necessary to give to the apparatus is to charge with gasoline from time to



Model Size 7—9.

time and wind the weight up, this in most cases only being requisite once a day; if the fall of the weight can be increased the weight needs to be raised less often. Even when the apparatus is working the weight can be wound up without disturbing the generation of the gas.

The driving weights are only supplied **when expressly asked for**, as they can generally be obtained more cheaply on the spot. A pump No. 50 568 is necessary and a mechanism for preventing explosions is desirable. 30 m wire rope are given in with the apparatus as also the driving chain and handle for winding up the weight; if the height through which the weight drops is increased a correspondingly larger quantity of wire rope should be ordered extra.

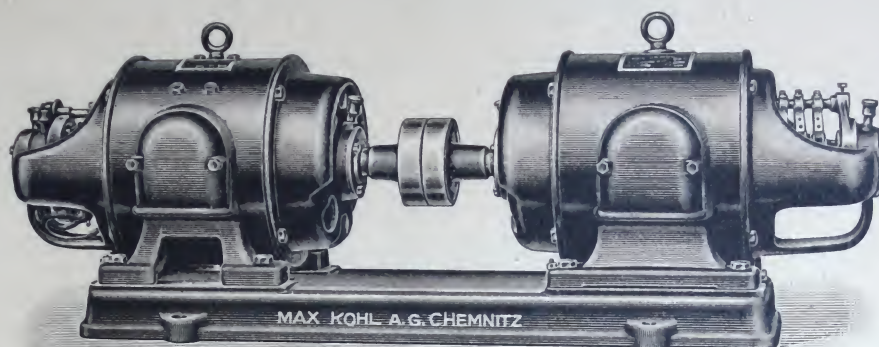
	£ s. d.
50 566. Driving Weights, per 100 kg	3. 0. 0

The weight mentioned in the preceding table is necessary.

50 568. Pump with adjusting cock, stand pipe with connections and angle aspirator	2. 10. 0
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Mechanism for preventing explosions {	Sizes	0—3	4—6	7—9
	Price	0. 16. 0	1. 5. 0	1. 15. 0

List No.	Size	Output in cubic-meters per hour (1 m ³ = 1000 l)	Bunsen or Teclu burners	Weight required	Prices £
82 241	1	2,5	10 pieces	150 kg	37. 10. 0
82 242	2	3,5	14 pieces	175 kg	40. 0. 0
82 243	3	4,5	18 pieces	225 kg	42. 10. 0
82 244	4	6	24 pieces	300 kg	46. 5. 0
82 245	5	9	36 pieces	400 kg	50. 0. 0
82 246	6	14	56 pieces	600 kg	62. 10. 0
82 247	7	19	76 pieces	750 kg	75. 0. 0
82 248	8	24	96 pieces	900 kg	88. 15. 0
82 249	9	30	120 pieces	1150 kg	111. 5. 0



82250. 1:12.

Electric Transformers, Motor-Generators

transforming Three Phase, Two Phase or Monophase Alternating Current
into Direct Current.

The majority of electrical apparatus for experimental purposes require direct current. Electrical apparatus driven by alternating or three phase current are seldom to be found. If, therefore, only alternating or 3-phase current is available, arrangements must be provided for transforming this into direct current.

A motor generator is best suited for this purpose. Such a motor generator consists of an electric motor for 3-phase or single phase alternating current with a continuous current dynamo coupled directly to it. Both machines are mounted on a massive iron base plate.

The motor must, in conformity with the rules of a number of electricity works, be provided with a slip ring rotor, to allow of its being started without causing large current rushes.

The dynamo is constructed as shunt dynamo for the purpose of charging also accumulators. The pressure best suited for general experimental purposes is 65 volts; it is e. g., sufficient for working a large arc lamp and for operating an induction coil in conjunction with a Wehnelt interrupter.

An experimental switchboard (preferably a board of the A_1 type, No. 50 471) is connected up direct to the terminals of the dynamo. With the aid of this switchboard it is not only possible to take off all desired current strengths, but also low voltages. Under or besides the experimental switchboard are placed the switch and fuses for the motor, the starter as well as the shunt regulator for the dynamo. The starting of the motor and regulation of the dynamo can in this manner be conveniently carried out from the switchboard while the transformer itself is installed in another room.

Transformers for connecting up to Three Phase Alternating Current Networks.

Three Phase-Direct Current Transformers, Figure, for connecting up to 3-phase Current of 110 or 220 volts and 50 cycles per second: consisting of a Three Phase Motor with Slip Ring Rotor, coupled to a Direct Current Shunt Dynamo for 65 volts; the two mounted on one massive iron base plate.

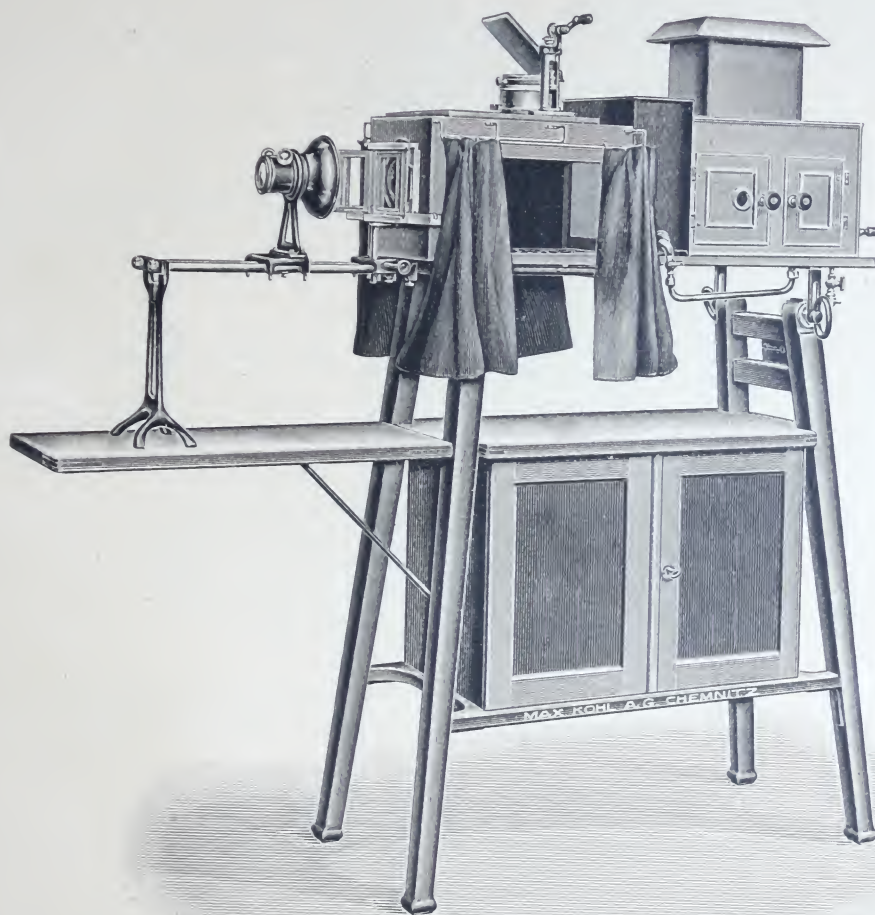
List No.	82 250	82 251	82 252
Motor { Efficiency, HP.	3	4	5
Motor { R. P. M.	1420	1420	1420
Shunt Dynamo { Output, watts	1790	2500	3060
Shunt Dynamo { Current at 65 volts, amperes	27,5	38,5	47
Prices of Transformers { a) 110 volts £	44.0.0	49.2.0	55. 8.0
for Network Voltages of { b) 220 volts £	45.0.0	50.0.0	56.10.0
Prices of Accessories { c) Starter £	2.4.0	2.12.0	2.16.0
Prices of Accessories { d) Shunt Regulator £	2.8.0	2. 8.0	2. 8.0
Weight of Transformer with Base-plate { nett . . . about kg	280	294	322
Weight of Transformer with Base-plate { gross . . about kg	357	387	427

Transformers for connecting up to Single Phase Alternating Current Networks.

Alternating-Direct Current Transformers (Figure on p. 1335), for connecting up to 110 or 220 volts Alternating Current, 50 cycles per second: comprising an Alternating Current Motor with Slip-Ring Rotor, coupled to a Direct Current Shunt Dynamo for 65 volts pressure, mounted on one massive iron base plate.

List No.	82 253	82 254	82 255
Motor { Efficiency, HP.	3	4	5
Motor { R. P. M.	1440	1440	1450
Shunt Dynamo { Output, watts	1790	2500	3120
Shunt Dynamo { Current at 65 volts, amperes	27,5	38,5	48
Prices of Transformers { a) 110 volts £	49.6.0	55.16.0	62.0.0
for Network Voltages of { b) 220 volts £	50.0.0	56.10.0	63.0.0
Prices of Accessories { c) Starter for Starting on half load £	4.2.0	4.16.0	5.4.0
Prices of Accessories { d) Shunt Regulator £	2.8.0	2. 8.0	2.8.0
Weight of the Transformer with Base-plate { nett . . about kg	289	303	363
Weight of the Transformer with Base-plate { gross . . about kg	382	398	473

Kohl's Megadiascope.



82 256. Megadiascope. Model A. 1:16.

The employment of electric light has greatly facilitated the introduction of various forms of projectors for educational purposes. The convenience, cleanliness and high candle-power of projection apparatus having an arc lamp as the source of illumination are such valuable qualities, that the use of such apparatus cannot be too highly recommended.

The high candle power especially enables experiments to be carried out which are impossible, or, at least, the same amount of completeness is not possible, when other sources of light are utilised. In connection with the complete range of experiments mention may be made of polarisation and spectrum experiments, the projection of microscopical preparations, and, more especially, the projection by reflected light of drawings, book, etc., illustrations and opaque objects.

For demonstration purposes the projection apparatus must be so built as to be adaptable to all the exigencies of demonstrating, and these are very numerous.

With a view to obtaining the maximum degree of adaptability we have constructed a new projection apparatus, the "Megadiascope."

The megadiascope can be thoroughly recommended for the following purposes:

a) Employing transmitted Light.

1. Projection of diapositives;
2. Projection of apparatus which are erected on the optical bench of the megadiascope;
3. Projection of apparatus independently of the optical bench, the instruments being placed in front of the megadiascope;
4. Projection of apparatus lying horizontally (magnets with lines of force, fluid strata, etc.) by transmitted light;
5. Projection of microscopical preparations by means of the projection microscope with or without ocular (Figure 82264);
6. Projection of microscopical preparations with a stand microscope vertically mounted;
7. Projection of microscopical preparations with a stand microscope horizontally mounted;
8. Demonstration of Spectrum phenomena (Figure 82278);
9. Demonstration of Polarisation phenomena in parallel and convergent light (Figure 82282);
10. Demonstration of Interference and Diffraction phenomena;
11. Producing a small pencil of light for the Lissajou curves, the oscillograph, etc.;
12. Projection with the cinematograph.

b) Employing reflected Light.

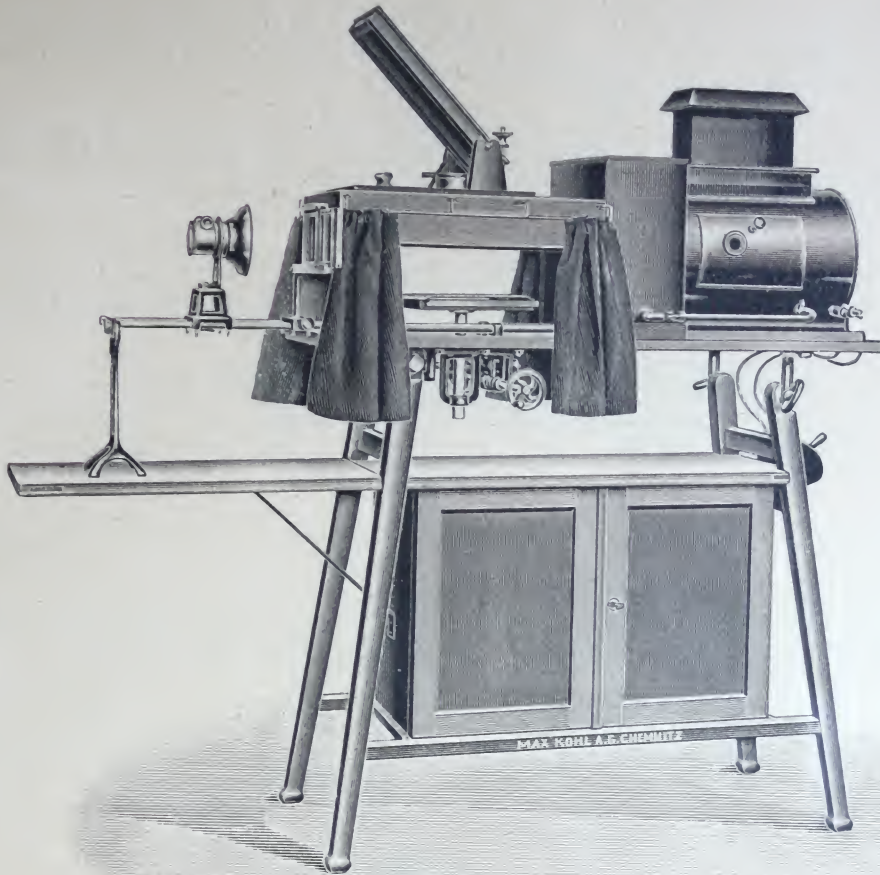
13. Projection of Wood-Cuts, Drawings and Flat Objects.

In conjunction with the wide scope of adaptability, the new megadiascope is very simple and convenient to manipulate and the apparatus can be changed over from one mode of projection to another in a few moments.

Source of Light. The source of light is a direct current arc lamp with horizontal carbons, the crater of the positive carbon being turned towards a parabolic mirror (Figure on page 1340). The total quantity of light from the lamp is reflected by the concave mirror to the condenser. By adopting this advantageous arrangement, considerable brilliancy of the image is obtained with a proportionately low current consumption, and opaque drawings, illustrations and flat objects are projected by reflected light with the requisite definition and brilliancy.

The direct current arc lamp is supplied with hand regulator, as the hand regulator enables the operator to obtain the highest luminous force just in the moment where it is required, whilst the automatic regulator fails in this moment.

Size of Image. Projection by transmitted light is effected by an objective of small focus, while for opaque objects projected by reflected light an objective of larger focus is used. The reason for this is that the diapositives ordinarily obtainable have an opening of image of 7×7 cm and require to be magnified 40 times if the size of the resultant image on the projection screen is to be 3×3 m. The illustrations to be projected should on the other hand, be as large as possible, since when these are magnified more than 20 times the images are not brilliant enough. If it be desired to carry out both systems of projection with a long focus objective, it will be then be necessary to alter the position of the apparatus, in order to get on the projection screen equally large images of the unequally large objects. With the small diapositives of 7×7 cm free opening of image, the distance of the megadiascope from the screen would have to be 13 m while in the case of drawings 17 cm in diameter a distance of 4 to 5 m from the screen would be correct. In many cases a variation of the distance in these limits is quite out of the question as the class rooms and lecture theatres are amphitheatrical in construction, thus rendering it impossible, or at least very inconvenient, to move the projection apparatus backwards



82 257. Megadiascope. Model B. 1:16.

and forwards. In the arrangement with two objectives of different foci the position of the megadiascope can remain unaltered, and images of sufficient and equal size are nevertheless obtained.

When for certain reasons it is desirable to place the megadiascope at a greater distance than 4 to 5 m from the screen, objectives of longer focus must be selected to allow of the image appearing on the screen not more than 3×3 m with consequent weakness of illumination. The following table explains the various ratios.

Table of Distances between Megadiascope and Screen, of Size of image appearing on the Screen and as to the focus of the Objectives.

Free aperture of the Diapositives $8,5 \times 8,5$ cm; size of the opaque images 17 cm.

Optical Outfit	Size	1	2	3	4	5
Focal Length of { Projection by transmitted Light	mm	150	150	180	210	240
the Objective for { Projection by reflected Light	mm	240	300	360	420	480
Size of Image on Screen		Distance between Megadiascope and Screen				
3×3 m		4 m	5 m	6 m	7 m	8 m
$3,5 \times 3,5$ m		4,6 m	5,8 m	7 m	8,15 m	9,3 m
4×4 m		5,3 m	6,6 m	8 m	9,3 m	10,6 m
$4,5 \times 4,5$ m		6 m	7,5 m	9 m	10,5 m	12 m

The Figure 82256 on page 1337 shows the megadiascope, model **A**, $\frac{1}{16}$ actual size; an illustration of model **B** is shown Figure 82257 on page 1339. The substructure has a small cupboard for containing the horizontal projector, megascope, etc.

The superstructure of both models is fitted with a sheet iron house containing the horizontally placed carbons and the parabolic mirror. In order to diminish the heat given off by the arc, the concave mirror has two walls of glass and is refrigerated with fresh running water (Figure). Also a water trough is placed into the way of the light cone likewise cooled with water.

The superstructure of the apparatus has in front an optical bench with objective carrier and objective, and an adjustable stage for holding the objects of projection. The optical bench is composed of two round metal rods maintained parallel by end pieces.

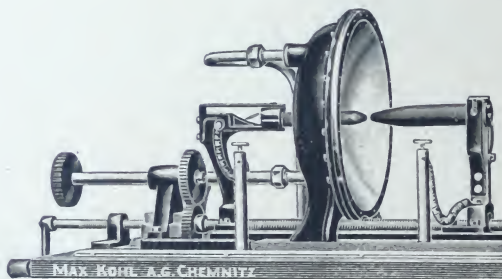
When not in use this bench can be pushed completely under the substructure, thereby rendering possible the setting up and projection of apparatus in front of the condenser independently of the bench. The bench is supported at its front end by a stand to prevent sagging when heavy instruments, etc. are placed on it.

A special apparatus is provided for projecting horizontal objects, and is placed on the megadiascope.

For projecting opaque, flat objects and woodcuts, drawings and other illustrations the Megascope is used, which is placed upon the megadiascope in place of the horizontal type projector.

For projecting microscopical preparations the projection microscope or a stand microscope is used. (Fig. 82264.)

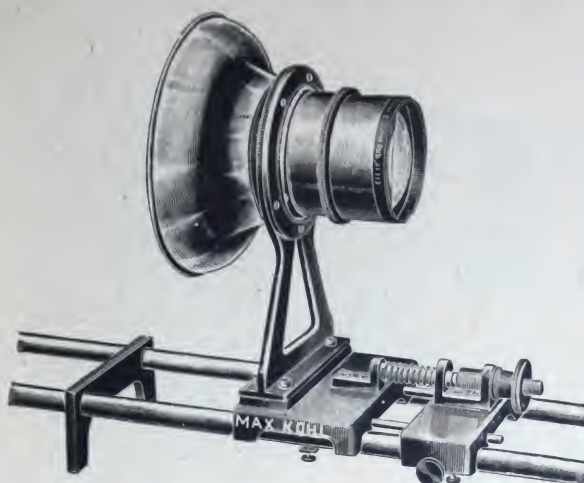
A little book "The lantern for projection" gives particulars in regard to the use of the megadiascope. The book has 84 pages with 109 illustrations and is sent cost-free to our customers on demand.



The horizontally placed carbons of the arc lamp with parabolic mirror, cooled with water, of the megadiascope Nr. 82256. 1:8.

Prices.

	£	s.	d.
82 256. Megadiascope , model A , Figure on page 1337, for projecting diapositives up to 9×12 cm and opaque illustrations up to 17 cm diam., projector arc lamp, handregulated, for direct current of 25 to 30 amperes, parabolic mirror with two walls of glass, 200 mm in diameter cooled with water, condenser lens of 140 mm diameter, achromatic projection objective of 150 mm focal length, 53 mm in diameter, focussing being secured by rack and pinion, continuous cooling water trough, objective carrier on slider, diapositive change-frame for diapositives 8½×8½ cm, 8½×10 cm and 9×12 cm, house of wood, projector chamber of metal with air circulation, doors with peep-glasses, stand inclinable of pine with case for storing the accessories. The megadiascope is equipped with:			
1 Horizontal Projection Apparatus with adjustable plane mirror of first class quality, condenser 150 mm in diameter, projection objective 53 mm in diameter with tilting erecting mirror silvered on the front in metal mount, and			
1 Megascope for projecting book illustrations, drawings and flat opaque objects by means of reflected light, having first quality illuminating mirror in metal mount, photographic objective of first class quality 1:4.5 of 250 mm focal length and 54 mm aperture, fine focussing being secured by rack and pinion			
			48. 0. 0



82 260. 1:6.

63 751. **Megadiascope**, model B, Figure on page 1339, for projecting diapositives up to 9×12 cm and opaque illustrations up to 22 cm diam., projector arc lamp, handregulated, **for direct current** of 30 to 50 amperes, parabolic mirror 280 mm in diameter, **cooled with water**, condenser lens 170 mm de diam., achromatic projection objective of 150 mm focal length, focussing being secured by rack and pinion, continuous cooling water trough, objective carrier on slider, diapositive change-frame for diapositives 8¹/₂×8¹/₂, 8¹/₂×10 and 9×12 cm, house of wood, projector chamber of metal with air circulation, doors with peep-glasses, stand of pine, with case for storing the accessories. The megadiascope is equipped with

1 Horizontal Projection Apparatus with adjustable plane mirror of first class quality, condenser 150 mm in diameter, projection objective 53 mm in diameter, with tilting erecting mirror silvered on the front in metal mount, and

1 Megascope for projecting book illustrations, drawings and flat opaque objects by means of reflected light, having first quality illuminating mirror in metal mount, a first class objective of 250 mm focal length and 54 mm aperture, fine focussing being secured by rack and pinion

£ s. d.

64. 0. 0

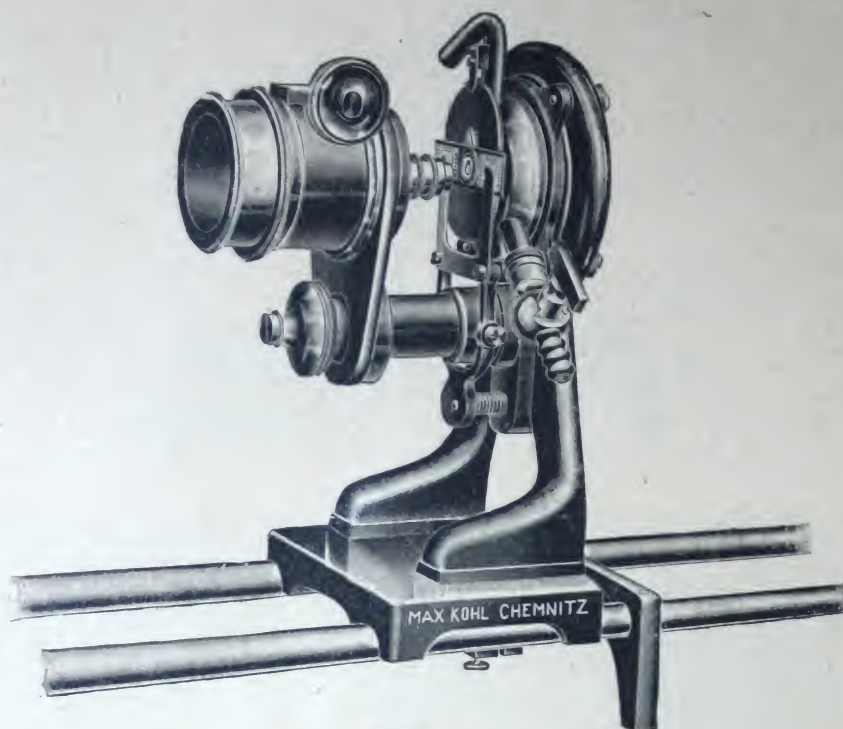
Extra Price for fitting objectives of longer focal length to the Megadiascope, and also the corresponding Condenser Lens.

For a distance between Megadiascope and screen } of . . . m (for 3×3 metres size of image on the screen ¹⁾)		5	6	7	8
Projection by Transmitted Light: } Focal length mm Petzval Projection Objective		150	180	210	240
Projection by Reflected Light: } Focal length mm f = 1 : 4,5		300	360	420	480
Extra Price £		7.10.0	15.0.0	22.10.0	30.0.0

¹⁾ For data relative to the **size of the image** on the screen when employing the various optical outfits, and at various distances between Megadiascope and screen, **see Table p. 1339.**

Accessories.

82 258. Sliders with upright , for mounting nicols, lenses, etc. on the optical bench . . . Each	0. 10. 0
82 259. — do., the column adjustable laterally by screw motion for demonstration of interference phenomena	0. 18. 0
82 260. Objective Holder with fine focussing, Figure, without lenses	1. 10. 0
82 261. Special carbons for the projector of Megadiascope for 25 amperes . . . Price per 10 pair	0. 2. 6
82 262. — do., for 30 amperes Price per 10 pair	0. 4. 0
82 263. — do., for 50 amperes Price per 10 pair	0. 6. 0



82 264. 1:5.

Microprojection with the Projection Microscope.

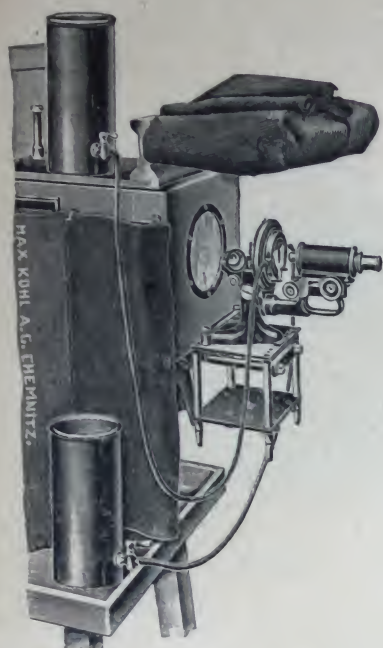
					£	s.	d.
82 264.	Projection Microscope , Figure, on slider, with coarse adjustment by rack and pinion and fine focussing by micrometer screw; with stage cooled by flowing water , object holder, insertion tube for the objectives and revolving diaphragm				5.	10.	0
82 265.	Ocular Tube for above				0.	5.	0
82 266.	Revolving Collar for 3 objectives				1.	2.	0
82 267.	Revolving Collar for 2 objectives				0.	16.	0
82 268.	Insertion Tubes for the objectives Each				0.	3.	0
82 269.	Hartnack Objectives:	No.	2	3	5	7	
	Price:	18 s.	1. 7. 0	1. 13. 0	1. 18. 0		
82 270.	Huyghens Oculars:	No.	2	3	4		
	Price:	5 s.	5 s.	5 s.			

Microprojection with a Stand Microscope.

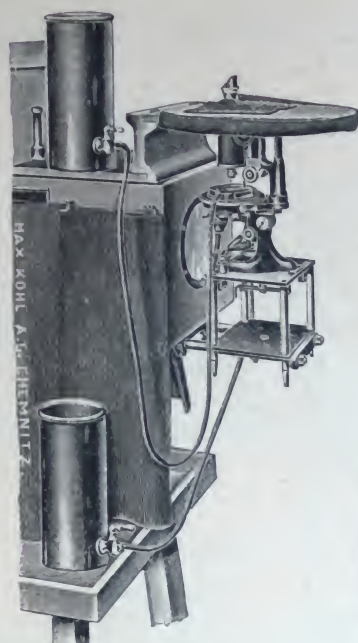
82 271.	Microscope Stand for Projection and Microphotography , with microphotographic stage and the usual condenser, collapsible. Price, without lenses				20.	15.	0
	Instead of being fitted with microphotographic stage, the stand can also be fitted with large transverse stage at the same price, if desired.						
82 272.	Above Microscope Stand , with folding condensers				22.	0.	0
82 273.	Sliders, with bridge pieces , for erection of microscope on optical bench, mounted horizontally as well as vertically				1.	12.	0

If it be desired to work with the microscope vertical, the following are essential:

82 274.	Illuminating Mirror , in mount				0.	6.	0
82 275.	Erecting Mirror for fastening on the tube of the microscope stand				2.	0.	0
82 276.	Small reversing prism , only to be used with oculars				1.	0.	0



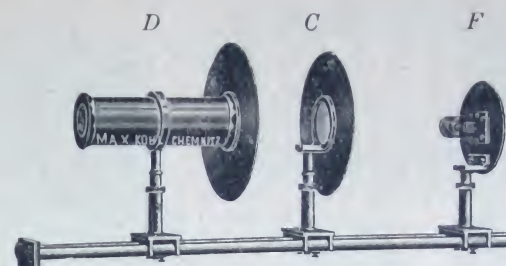
82 277. 1:14.



82 277. 1:14.

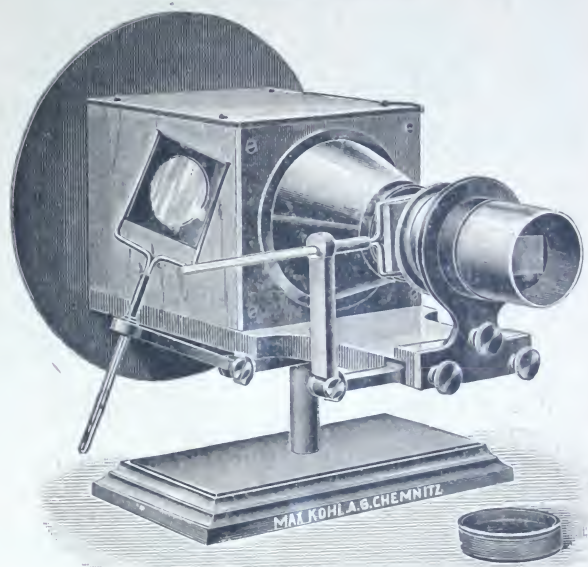


54 029/54 031. 1:6.



D = Direct-vision prism, *C* = Collimator lens,
F = Adjustable slit.

82 278, 82 279, 82 280. 1:10.



82 282. 1:4.

82 277. **Zoth's Cooling Device**, Figure, for placing on the Microscope Table, including 2 sheet iron vessels, with cocks and rubber tubing, and screen for excluding outside light . . . £ s. d.
3. 0. 0

Projection of the Spectrum.

82 278. 1 Adjustable slit with micrometer screw, Figure . . . 1. 7. 0
82 279. 1 Collimator lens with diaphragm and handle, Figure . . . 0. 17. 0

Direct-Vision Prisms after Königsberger, Figure, filled with durable liquid:

List-No.	54 029 a	54 030	54 031
Free Aperture mm	25 × 25	40 × 40	55 × 55
Price: £	1. 16. 0	2. 10. 0	4. 10. 0

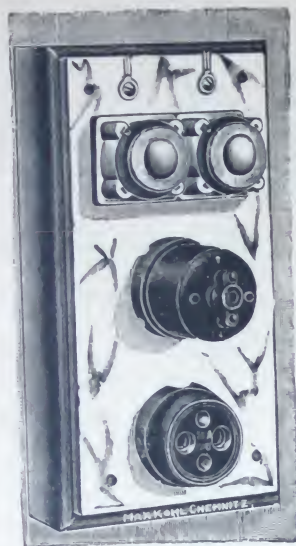
82 280. 1 **Direct vision prism**, consisting of 3 crown and 2 flint glass prisms, 38 × 41 mm side, 180 mm long, in mount, with handle, Figure . . . 8. 15. 0

82 281. **Absorption Vessel**, 55 × 35 × 10 mm internal diameter . . . 0. 3. 6

For spectral projection 3 sliders with stand, No. 82 258, are indispensable. For all experiments a total of 5 sliders with stands, No. 82 258, and 1 slider, No. 82 259, are necessary.

Polarisation-Projection with the Projection-Polarisation Apparatus.

82 282. **Projection-Polarisation Apparatus**, Figure, with large column of glass plates (the plates being of the finest white, thin plate glass) with great nicol, and with arrangement for clamping preparations . . . 7. 0. 0



82 286. 1:6.



82 287/92. 1:12.



82 293. 1:10.



82 294. 1:8.

Production of a narrow Cone of Rays for demonstrating the Lissajous Curves, the Oscillograph, etc.

82 283. Diaphragm, with fine aperture, and with holder	£ s. d.
82 284. Lens, 80 mm diameter and 170 mm focal length, with diaphragm and holder	0. 6. 0
	0. 15. 0

Projection with the Cinematograph.

82 285. Cinematograph for use in conjunction with lanterns, cf. Fig. 82 346 p. 1251, with first-class cinema projector; objective of 42,5 millimetres diameter, focal length 70—120 millimetres, automatic film winding gear, automatic fire screen, one detachable and two fixed film reels each holding 400 metres of film; light screen with trough-holder; trough for cooling liquid, 1 pair of fire-protecting drums for films 400 metres in length, with complete gear for stopping and running the film backwards, including universal motor 1/13 H. P., with starter, which can be used for 110/220 V. continuous or alternating current	35. 0. 0
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Switchboards and Resistances.

82 286. Switchboard for connecting the Megadiascope with the wall, Figure, for 30 amperes maximum, without series resistance, suitable for the Megadiascope, model A	1. 10. 0
The switch panel, of polished marble, contains a double-pole cartridge fuse, a double-pole instantaneous switch, and a double-pole plug box with plugs and the necessary connections.	

82 286 a. — do., for 50 amperes maximum, Figure, suitable for model B	2. 10. 0
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Rheostat, for placing on the floor, Figure, for currents to 30 amperes.

List No.	82 287	82 288	82 289
Working Pressure	80	110	220 Volts
Prices: £	5. 0. 0	5. 5. 0	9. 10. 0

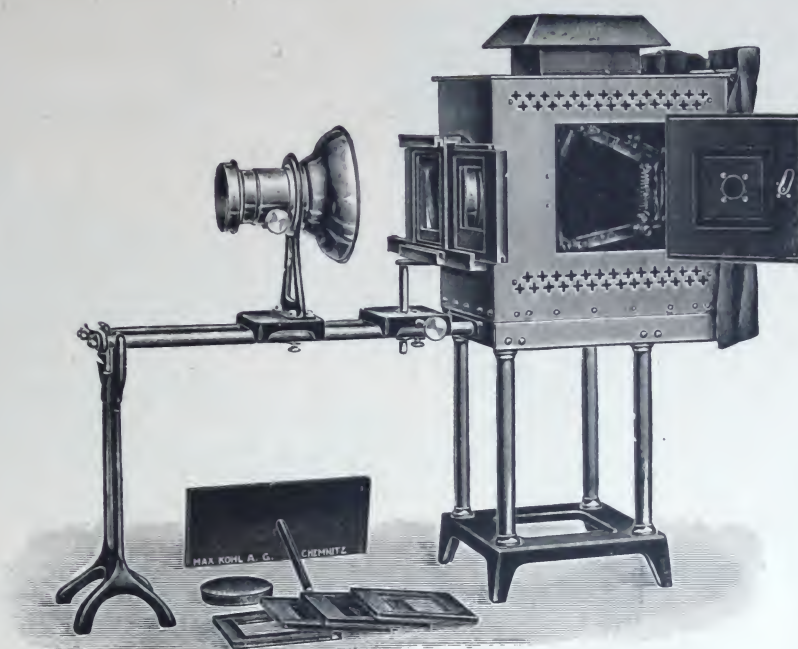
— do., for placing on the floor, Figure, for currents to 50 amperes.

List No.	82 290	82 291	82 292
Working Pressure	80	110	220 Volts
Prices: £	6. 0. 0	8. 10. 0	12. 10. 0

82 293. Water Inlet and Waste, Figure, consisting of a water cock for the pipes, and a lead funnel on wall bracket for screwed joint for the waste pipe, for fixing to the wall	0. 13. 0
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82 294. — The above Apparatus, Figure, for building into the floor, in iron case with cover	1. 10. 0
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Projection Apparatus and Accessories.



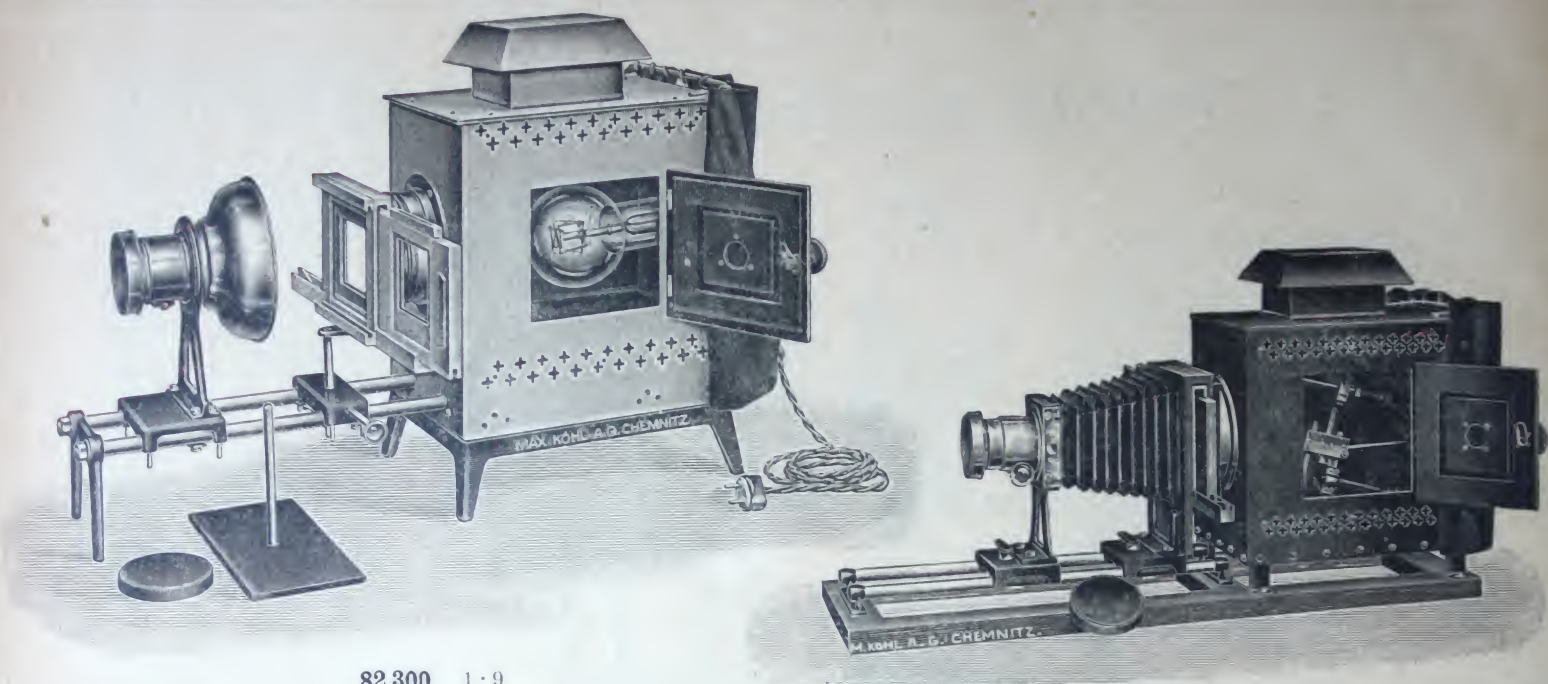
50 735. 1 : 10.

School Projection Apparatus, Model A, on tall legs, Figure, for projecting apparatus and diapositives; with Condenser, Achromatic Objective, Optical Bench, Change Frame with smaller frame inserted for taking diapositives $9 \times 10,5$ cm, $8,5 \times 10$ cm and 9×12 cm; 1 stage and one movable slider with stand in which to insert the change frame, the stage or other objects.

With Achromatic Projection Objective	Condenser Diameter mm	102	122	152
	Objective Diameter mm	43	55	65
	Focal length of Objective mm	150	180	250
With Arc Lamp for hand regulation, No. 50 890		List No. 50730 £ 13.0.0	50735 14.0.0	50740 15.10.0
With Projector Half-Watt Lamp		List No. 50730 a £ 13.10.0	50735 a 14.10.0	50740 a 16.0.0
With Limelight Burner for House gas and Oxygen, No. 50 936		List No. 50733 £ 11.10.0	50738 12.10.0	50743 14.0.0
With Incandescent Spirit Burner, No. 50 964		List No. 50734 £ 12.10.0	50739 13.10.0	50744 15.0.0

The housing is composed of aluminium walls; it has a door, in the side wall, having dark glass peep holes, and a further observation window on the opposite side. The lamp is manipulated from behind. For this purpose the back is fitted with a sliding door which can be completely removed. The disturbing light radiated from behind is prevented from issuing from the lantern by black curtains, the housing being well ventilated. The condenser is fitted to the front wall, the optical bench being placed in front of the latter, and carrying two sliders: one of those shown in the illustration carries the diapositive holder with change frame, while the other carries the objective-holder together with the objective. When not in use the bench can be pushed completely under the substructure, thereby rendering possible the setting up and projection of apparatus in front of the condenser independently of the bench.

A little book „The lantern for projection“ gives particulars in regard to the use of our projection apparatus. The book has 84 pages with 109 illustrations and is sent cost-free to our customers on demand.



82 300. 1:9.

50 778. 1:11.

School Projection Apparatus, Model C, Figure, new construction, for projecting diapositives and apparatus, with Condenser, Achromatic Objective, Optical Bench, Change Frame with smaller frame inserted for taking diapositives 9×10,5 cm, 8,5×10 cm and 9×12 cm; 1 stage and one movable slider with stand in which to insert the change frame, the stage or other objects.

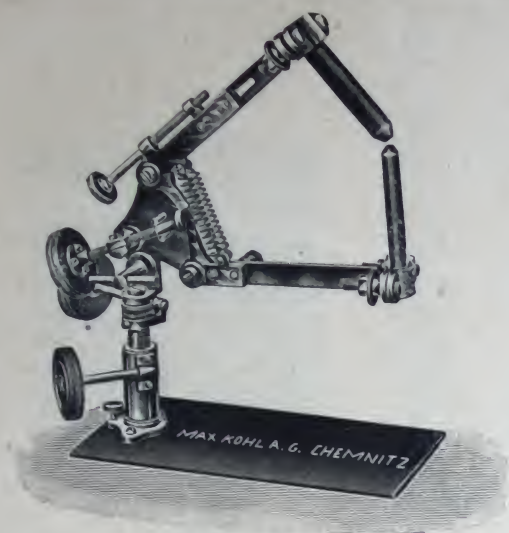
With Achromatic Projection Objective	Condenser Diameter mm	102	122	152
	Objective Diameter mm	43	55	65
	Focal Length of Objective mm	150	180	250
With Arc Lamp for hand regulation, No. 50 890		{ List No. 82 295	82 299	82 303
		{ £ 11. 10. 0	12. 10. 0	14. 0. 0
With Half-Watt Projector Lamp		{ List No. 82 296	82 300	82 304
		{ £ 12. 0. 0	13. 0. 0	14. 10. 0
With Limelight Burner for House gas and Oxygen, No. 50 936		{ List No. 82 297	82 301	82 305
		{ £ 10. 0. 0	11. 0. 0	12. 10. 0
With Incandescent Spirit Burner, No. 50 964		{ List No. 82 298	82 302	82 306
		{ £ 11. 0. 0	12. 0. 0	13. 10. 0

The housing is composed of aluminium walls; it has a door, in the side wall, having dark glass peep holes, and a further observation window on the opposite side. The lamp is manipulated from behind. For this purpose the back is fitted with a sliding door which can be completely removed. The disturbing light radiated from behind is prevented from issuing from the lantern by black curtains, the housing being well ventilated. The condenser is fitted to the front wall, the optical bench being placed in front of the latter, and carrying two sliders: one of those shown in the illustration carries the diapositive holder with change frame, while the other carries the objective-holder together with the objective. When not in use the bench can be pushed completely under the substructure, thereby rendering possible the setting up and projection of apparatus in front of the condenser independently of the bench.

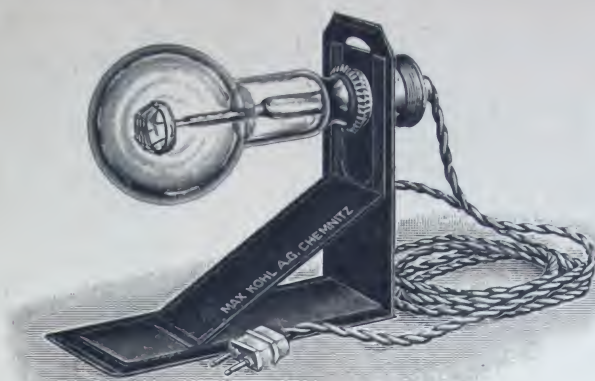
School Projection Apparatus, Model D, for projecting diapositives and apparatus, Figure, with detachable extending bellows, Condenser, achromatic Objective, Optical Bench, change frame with small frame for taking diapositives 9×10,5 cm, 8,5×10 cm, and 9×12 cm; 1 Stage and 1 Slider with stand for inserting the change frame, the stage or other objects.

With Achromatic Projection Objective	Diameter of Condenser mm	102	122	152
	Diameter of Objective mm	43	55	60
	Focal Length of Objective mm	150	180	250
With hand-regulating Arc Lamp, No. 50 890		{ List No. 50 768	50 773	50 778
		{ £ 13. 15. 0	14. 10. 0	16. 10. 0
With Half-Watt Projection Lamp		{ List No. 50 768 a	50 773 a	50 778 a
		{ £ 14. 5. 0	15. 0. 0	17. 0. 0
With Limelight Burner for House Gas and Oxygen, No. 50 936		{ List No. 50 771	50 776	50 781
		{ £ 12. 5. 0	13. 0. 0	15. 0. 0
With Spirit Incandescent Burner, No. 50 964		{ List No. 50 772	50 777	50 782
		{ £ 13. 5. 0	14. 0. 0	16. 0. 0

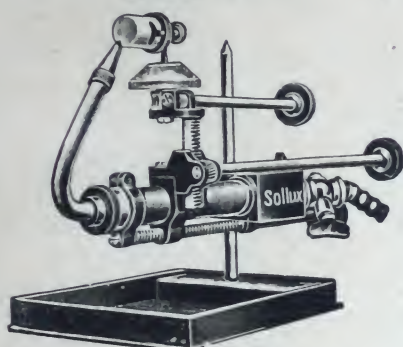
Max Kohl, Aktiengesellschaft, Chemnitz, Germany.



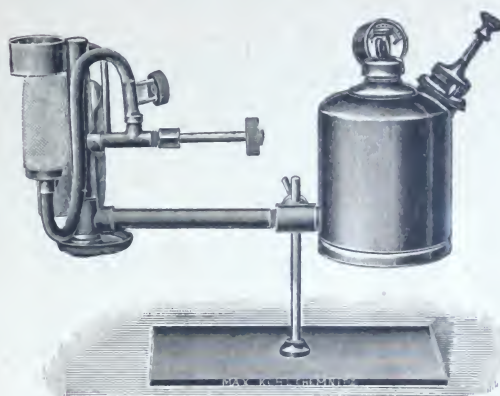
50 890. 1:4.



82 310, 82 311, 82 315. 1:6,5.



82 324. 1:5.



50 964. 1:6.

- 50 890. Projector Arc Lamp, for hand regulation, Figure. for currents to 35 amperes . . . £ s. d. 2. 17. 0
50 891. — do., for currents to 50 amperes . . . 3. 15. 0

Carbons for Direct Current Arc Lamps.

Current	Amps.	10—15	20—25	30—35
Diameter of cored carbon	mm	14	16	20
Diameter of solid carbon	mm	10	11	14
List No.		82 307	82 308	82 309
Price per 10 pairs 100 mm (about 4") long	£	0. 1. 2	0. 1. 4	0. 1. 10

- 82 310. Stand for the Half-watt Projector Lamp, adjustable up and down, with lead, plug and plug-contact, with Edison-holder for lamps up to 200 watts, Figure . . . 0. 11. 0
82 311. — idem, with Goliath lamp-holder for lamps of from 300—1500 watts, Figure . . . 0. 12. 0

Projection Half-Watt Lamps for Direct and Alternating Current. Can be used off any supply, Figure.

110 Volts					220 Volts				
Watts	List-No.	Candle Power	Amps.	Price £	List-No.	Candle Power	Amps.	Price £	
100	82 312	150	—	0. 5. 0	82 318	100	—	0. 5. 0	
200	82 313	400	—	0. 8. 0	82 319	300	—	0. 8. 0	
300	82 314	600	2,7	0. 12. 0	82 320	500	1,5	0. 12. 0	
500	82 315	1250	4,5	0. 16. 0	82 321	1000	2,5	0. 16. 0	
1000	82 316	2500	9	1. 2. 0	82 322	2000	4,5	1. 2. 0	
1500	82 317	4000	13,5	1. 12. 0	82 323	3500	7	1. 12. 0	

The lamps up to 200 watts have standard Edison screw sockets and the larger ones from 300—1500 watts Goliath screw sockets. When the lamps are burning, care should be taken to see that the filaments hang vertically and are not horizontal. If the latter, the filaments sag and risk coming into contact with each other.

- 82 324. Limelight Burner, Figure, for house gas and oxygen, or for hydrogen and oxygen, with regulating taps. The lime cylinder can be rotated and adjusted vertically by bevil gear. With support and plate . . . 1. 15. 0

- 50 964. Spirit Incandescent Burner, Figure, with pressure pump, manometer, pure nickel reflector and 4 double mantles . . . 2. 10. 0

An excellent source of light is obtained with this burner. as pictures 4 metres square can be secured with it. The arrangement is quite simple and safe to manipulate. The pressure is generated by a small pressure pump and should be about 1 atmosphere. The construction differs from the illustration.



50 873. 1:8.



82 329. 1:10.



82 337. 1:6.

Series Resistances for Direct Current Projector Arc Lamps, Figure, Not adjustable, for fixing to the wall or standing on the floor.

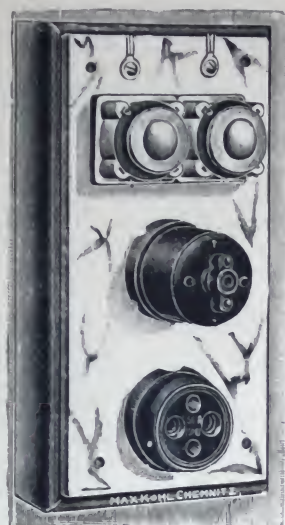
Working pressure Volts	65	110	150	220
List No.	50 868	50 869	50 870	50 871
Lamp Current Amps.	15	15	15	15
Price £	1. 0. 0	1. 15. 0	2. 10. 0	4. 0. 0
List No.	50 872	50 873	50 874	50 875
Lamp Current Amps.	20	20	20	20
Price £	1. 5. 0	2. 0. 0	3. 0. 0	5. 0. 0
List No.	50 876	50 877	50 877 a	50 877 b
Lamp Current Amps.	25	25	25	25
Price £	1. 10. 0	2. 10. 0	4. 0. 0	6. 0. 0

Series Resistances for Direct Current Projector Arc Lamps, Figure, Regulation by handle, for fixing to the wall or standing on the floor.

Working pressure Volts	65	110	220
List No.	82 325	82 326	82 327
Lamp Current Amps.	7—15	7—15	7—15
Price. £	2. 18. 0	3. 9. 0	5. 15. 0
List No.	82 328	82 329	82 330
Lamp Current Amps.	10—20	10—20	10—20
Price £	3. 0. 0	3. 13. 0	6. 2. 0
List No.	82 331	82 332	82 333
Lamp Current Amps.	15—30	15—30	15—30
Price £	3. 4. 0	3. 16. 0	6. 12. 0

Projector Arc Lamps Transformers, with separate copper windings. A magnetic shunt built in automatically steadies the arc.

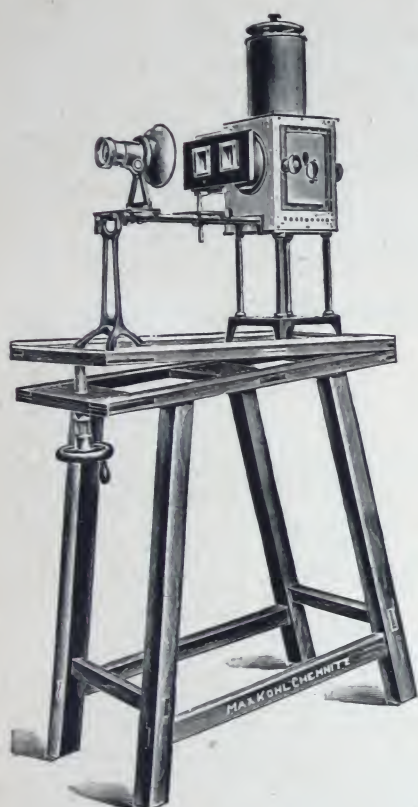
Working pressure Volts	50 cycles Monophase Alternating Current			
	110 and 120	210 and 220	380	110, 120, 210 and 220
List No.	82 334	82 335	82 336	82 337
Lamp Current Amps.	20	20	20	20
Price £	3. 10. 0	3. 10. 0	3. 10. 0	4. 6. 0
List No.	82 338	82 339	82 340	82 341
Lamp Current Amps.	25	25	25	25
Price £	3. 14. 0	3. 14. 0	3. 14. 0	4. 8. 0
List No.	82 342	82 343	82 344	82 345
Lamp Current Amps.	30	30	30	30
Price £	3. 16. 0	3. 16. 0	3. 16. 0	4. 12. 0



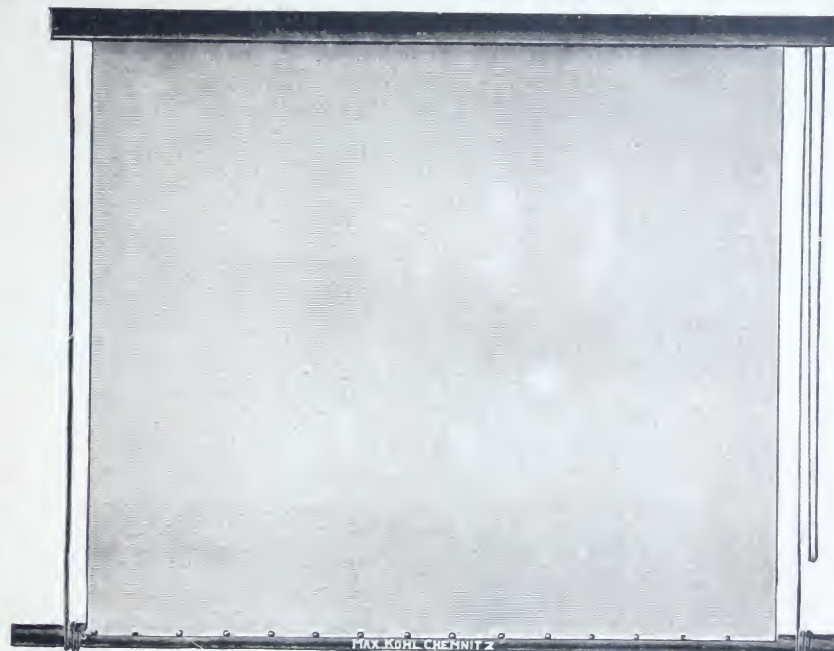
50 878. 1:6.



50 994. 1:20.



50 996. 1:24.



51 007. 1:33.

- 50 878. **Switchboard** for connecting up the Projection Apparatus with the wall, Figure, can be used for current of up to 30 amperes. Price without series resistance £ s. d. 1. 10. 0
- 50 994. **Stand for Projection Lanterns**, size of top 90×45 cm, with hand wheel and gearing for vertical adjustment; table top is rotatory. Figure 4. 10. 0
This table top is intended for setting up Model A and B lanterns. Prices on application for other lanterns.
- 50 996. **Table for Projection Lanterns**, with tilting top; size 100×50 cm, top of oak, body of pine, Figure. Price, without lantern 3. 0. 0

Projection Screens.

Projection Screen with Rolling-up Device by means of draw cord, Figure, the screen being of prepared pure white fabric, suitable for reflected light; for fixing firmly on the wall, on the ceiling, or above the cornice of the blackboard frame.

List No.	51006	51007	51008	51009	51010	51010a
Size m	2,5×3	3×3	3,5×3,5	4×4	4,5×4,5	5×5
£	2. 10. 0	3. 0. 0	3. 15. 0	5. 5. 0	7. 0. 0	9. 5. 0

These screens have a dead white surface, are 3 m long without seam, and are kept above the cornice under waxed cloth strips, thus preventing their becoming damaged or covered with dust when not in use.

Projection Screen with Metallic Coating, with draw-cord device for rolling up (cf. Fig. 51 007), for reflected light; for fixing firmly on the wall, the ceiling, or above the cornice of the blackboard frame.

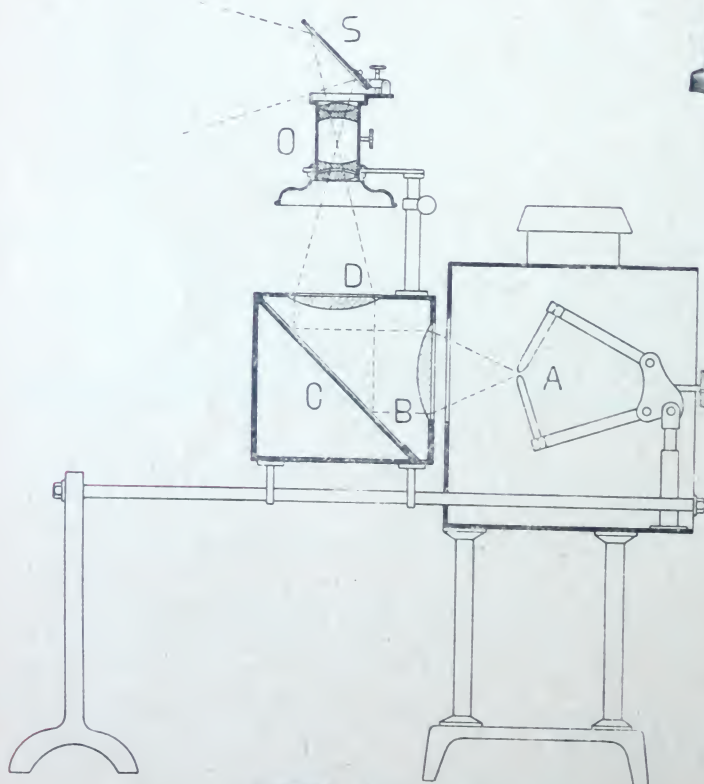
List No.	51011	51012	51013	51014
Size m	2×2	2,5×2,5	3×3	3,5×3,5
£	3. 0. 0	4. 5. 0	5. 10. 0	7. 0. 0



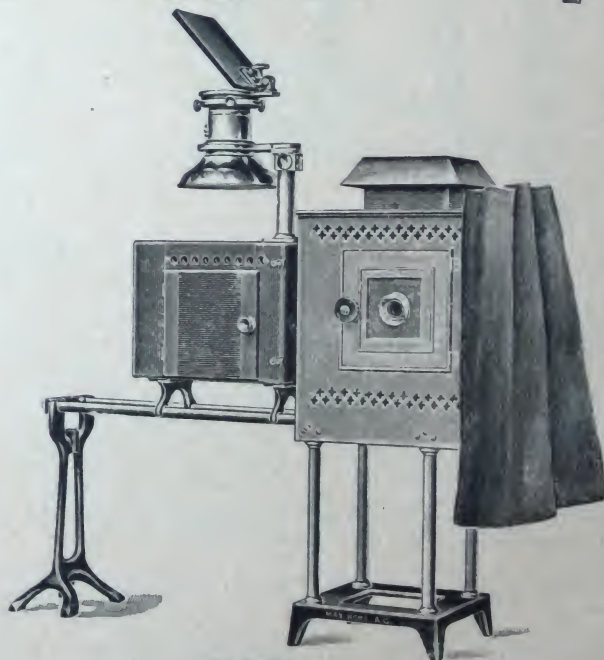
51 024. 1:30.



51 027. 1:30.



51 032 A. 1:10.



51 032 B. 1:12.

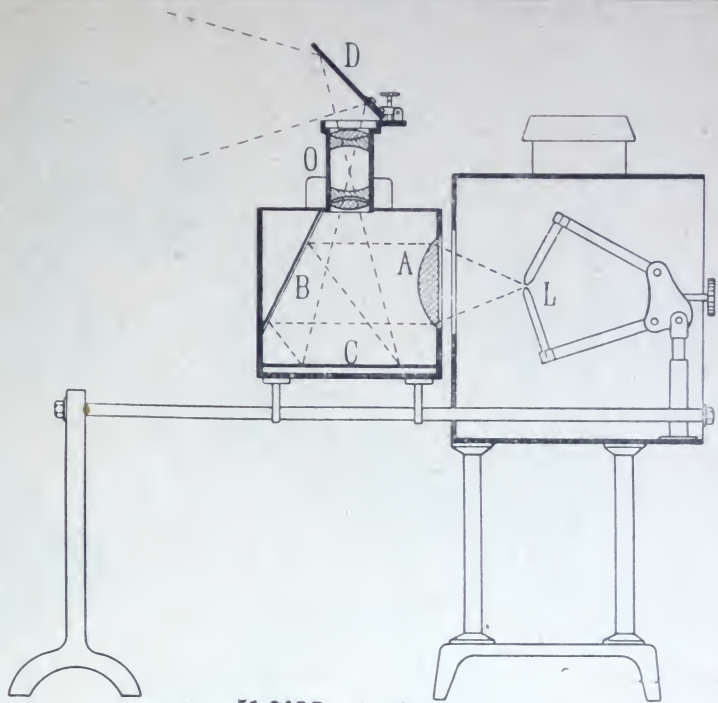
- | | |
|--|---------|
| 51 024. Portable Wooden Stand, Figure, with Projection Screen, size 2,4×2,4 m, of white linen, in carrying bag; parts can be taken to pieces (Frick, Phys. T., Fig. 349) | £ s. d. |
| 51 025. — do., with screen, 3×3 m | 3. 0. 0 |
| 51 026. — do., with screen, 4×4 m | 4. 0. 0 |
| 51 027. — Portable Wooden Stand with Projection Screen for rolling up, size 2,5×3 m, Figure | 6. 0. 0 |

Auxiliary Apparatus for Projection Purposes.

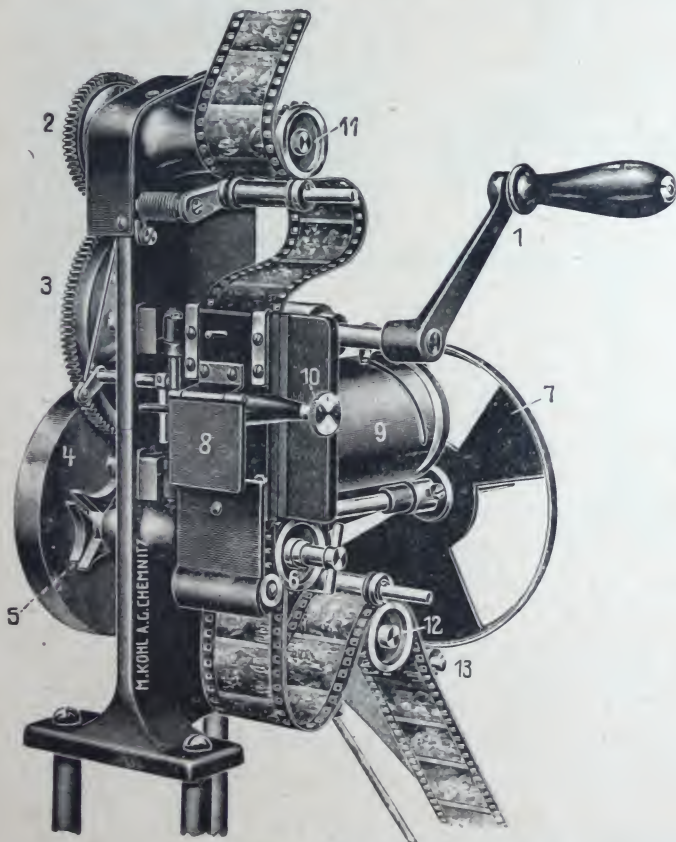
- | | |
|--|---------|
| 51 032. Apparatus for Projecting Horizontal Objects, Figure, with 2 condenser lenses, 122 mm diameter, 1 projection objective, 55 mm diameter, and 1 erecting mirror silvered on the front | 6. 0. 0 |
|--|---------|
- By using an erecting mirror silvered on the front "ghosts" are obviated and greater sharpness of image is secured. The figure shows the apparatus in connection with a lantern for projection, which is not included in the price.



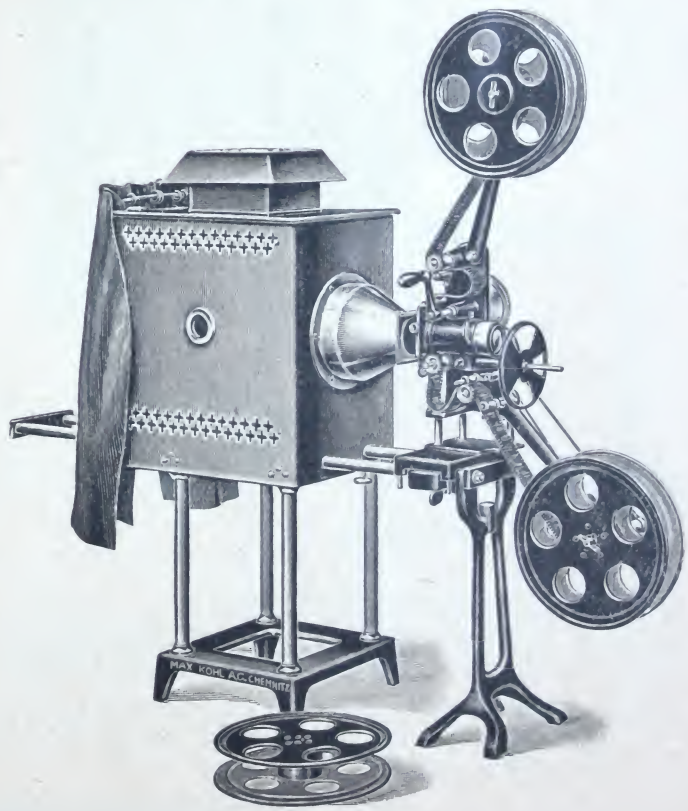
51 046 A. 1:8.



51 046 B. 1:10.



82 346 A. 1:3.



82 346 B. 1:12.

51 046. **Megascope** for Projecting opaque objects, Figure, large Model, with illuminating lens, illuminating mirror, achromatic Objective and erecting mirror silvered on the front . . .

£ s. d.
6. 10. 0

For projecting wood cuts from text books, photographs, the inside of a watch, etc.

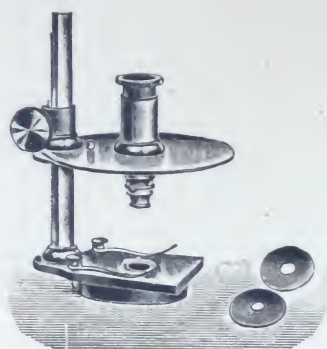
The apparatus is set up in front of the projection lantern after removing the condenser. The light passes through the large lens on to the illuminating mirror, being thence projected on the opaque object, which is laid upon the bottom of the apparatus. The objective and plane mirror above cast an image on to the projection screen

82 346. **Cinema Apparatus** for use with the projection lantern, Figures 82 346 A and B, with objective 42,5 mm diameter, focal length (as preferred) from 7 to 12 cm; automatic film winding device, automatic fire protector, with 1 collapsible and 2 fixed film reels holding 200 metres (abt. 650 ft.) of film, including gear for fixing to the bench of the projection lantern . . .

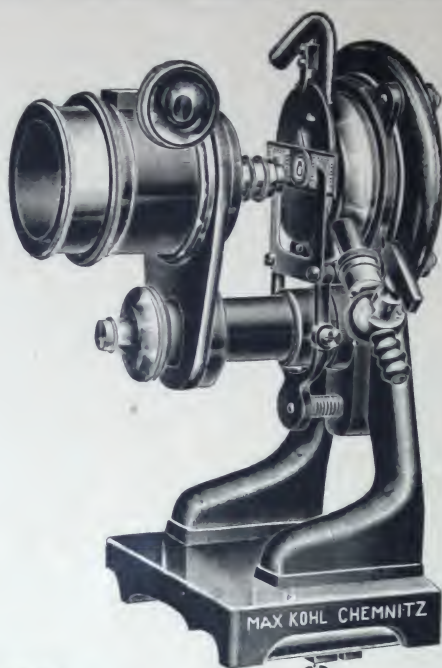
10. 10. 0

Extra price, if the apparatus is required with arms and reels for films 400 metres (abt. 1280 ft.) long

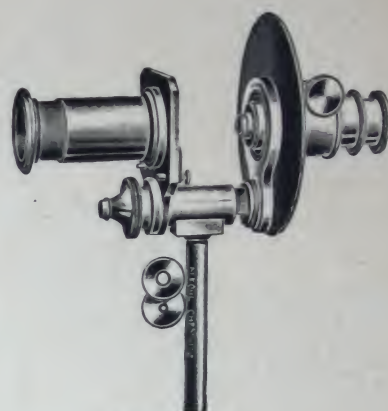
0. 10. 0



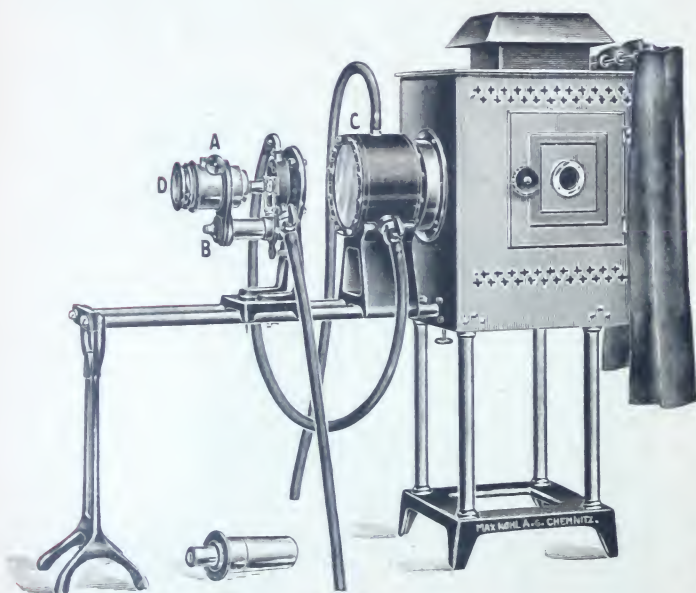
51 047. 1:5.



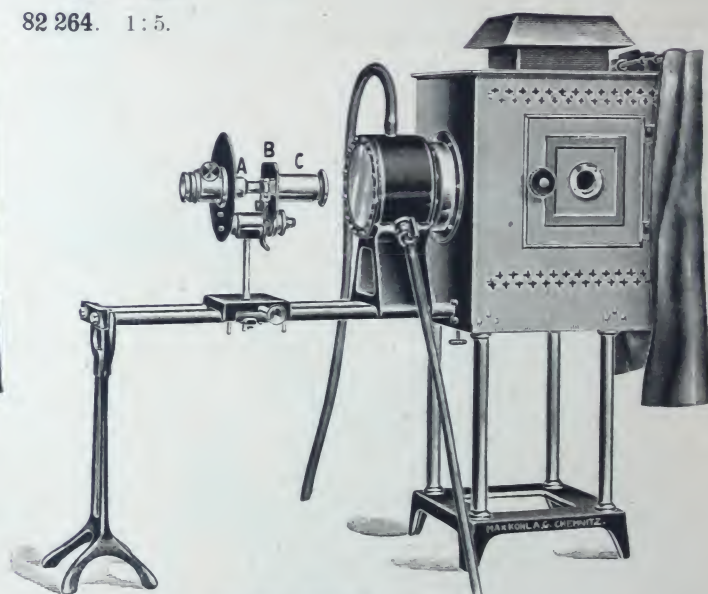
82 264. 1:5.



51 048. 1:5.



82 264, 50 976. 1:12.



51 048 50 976. 1:12.

82 347. Simple Conical Light Shield

82 348. 1 Top and 1 Bottom Fire-protection Drum for a film length of 200 metres

82 349. 1 Top and 1 Bottom Fire-protection Drum for a film length of 400 metres

82 350. Stopping Gear consisting of hand drive, vane protector, folding vane and adjusting knob, light shield with trough holder, trough for cooling liquid, 25 grams of salt for preparing the cooling liquid

£	s.	d.
0.	4.	0
1.	8.	0
2.	10.	0
3.	18.	0

Microprojection with the Projection Microscope.

51 047. Projection Microscope for Projecting Microscopical Preparations, Figure, with rack motion, but excluding objective

The microscope can also be fitted with 2 bright tourmaline discs to enable polarisation phenomena to be demonstrated.

2. 10. 0

51 048. — The preceding, with Micrometer Adjustment for high magnifications, Figure

4. 0. 0

82 264. Projection Microscope, Figure, on slider, with coarse adjustment by rack and pinion and fine focussing by micrometer screw; with stage cooled by flowing water, object holder, insertion tube for the objectives and revolving diaphragm

5. 10. 0

82 265. Ocular Tube for above

0. 5. 0

82 266. Revolving Collar for 3 objectives

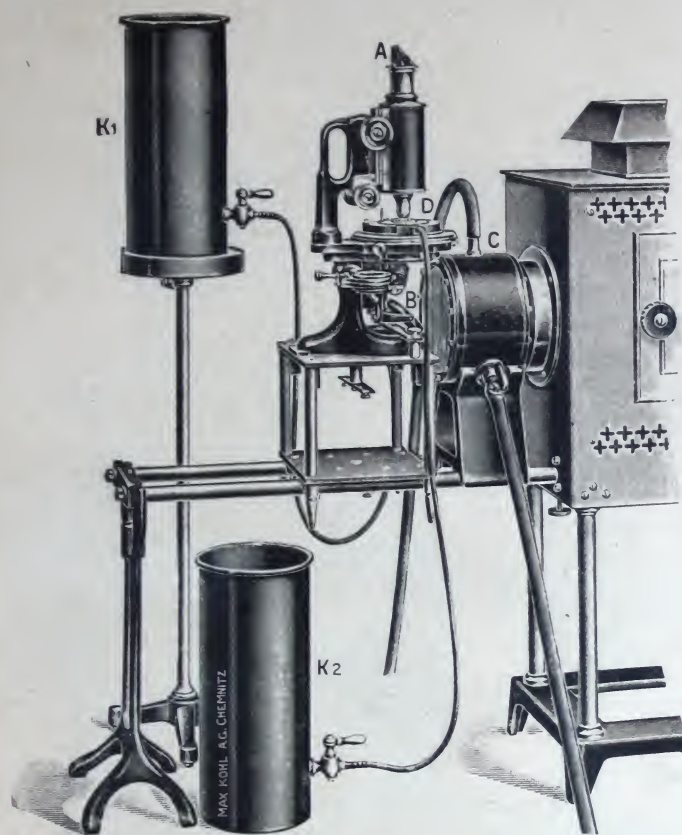
1. 2. 0

82 267. Revolving Collar for 2 objectives

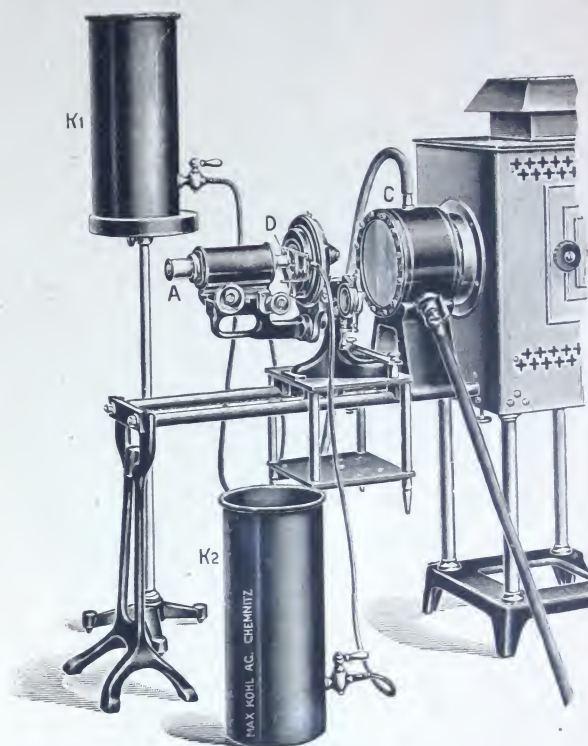
0. 16. 0

82 268. Insertion Tubes for the objectives

Each 0. 3. 0



50 976, 82 277, 82 351. 1:10.



50 976, 82 277, 82 351. 1:12.

Objectives for the Projection Microscope.

List No.	51 049	51 050	51 051	51 052
Hartnack Objective No.	2	3	5	7
£	0. 18. 0	1. 7. 0	1. 13. 0	1. 18. 0

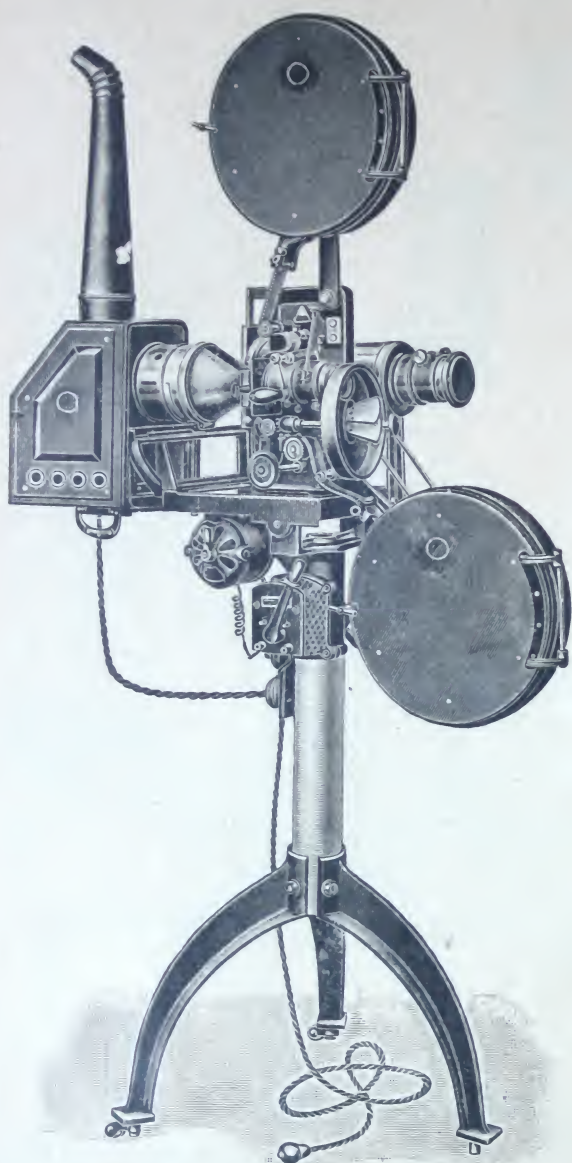
£ s. d.

Cooling Tank, for continuous-flow cooling by water (Figure), fitted with good plate glasses.

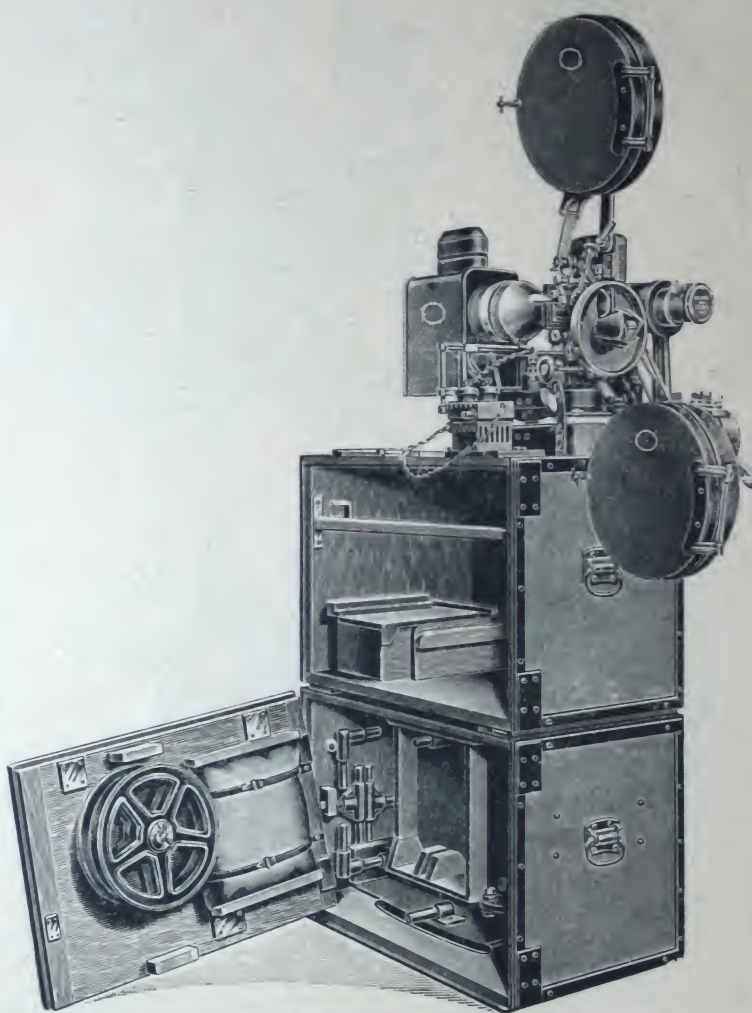
List No.	50 976	50 977
Diameter of Condenser mm	102 and 122	152
£	2. 0. 0	2. 10. 0

Micro-Projection with a Stand Microscope.

82 271. Microscope Stand for Projection and Microphotography , Figure, with microphotographic stage and the usual condenser, collapsible, Price, without lenses . . .	20. 15. 0
82 351. Device for fixing the microscope stand at various heights on the optical bench of the projection lantern , cf. illustration . . .	1. 12. 0
82 275. Erecting Mirror for fastening on the tube of the microscope stand . . .	2. 0. 0
82 276. Small reversing prism , only to be used with oculars . . .	1. 0. 0
82 277. Zoth's Cooling Device , for fixing to the microscope table, including fixing device, also two sheet iron containers with rubber tube and 1 stand for fixing one of the containers. Cf. illustration . . .	3. 0. 0



82 352. 1:13.



82 353. 1:15.

Max Kohl, Aktiengesellschaft, Chemnitz, Germany.

82 352. **School Cinema Apparatus (Illustrated)**, arranged for showing both cinema films and lantern slides. This is an independent piece of apparatus on iron column with raising and lowering gear for manipulating the apparatus about a horizontal plane. The projector portion, of excellent construction, includes objective of 52,5 mm diameter, focal length 85 to 120 mm (as required), automatic film winding gear, one collapsible and two fixed film reels each holding 400 metres (1280 ft.) of film. The optical portion of the lantern part of the apparatus has an objective 62,5 mm diam, focal length 350—500 mm as required, for glass slides 8,5×8,5 cm (about 3¼×3¼ ins.) or 8,5×10 cm (3¼×4 ins.), with holders and three supports for same. The Lamp chamber slides along rails. There is a triple condenser 120 mm diam., adjustable lamp holder with concave mirror, swing back light screen, also one top and one bottom fire-protection drum; 3 metres (9½ ft.) of flex with plug for goliath lampholder; one tubular lamp for 500 watts and 110 volts. The apparatus is fitted with complete Stopping Gear, including universal 1/13 HP. motor for 110 volts direct current **or** for 110 volts alternating current, **or** for 110 volts direct and alternating current

£ s. d.

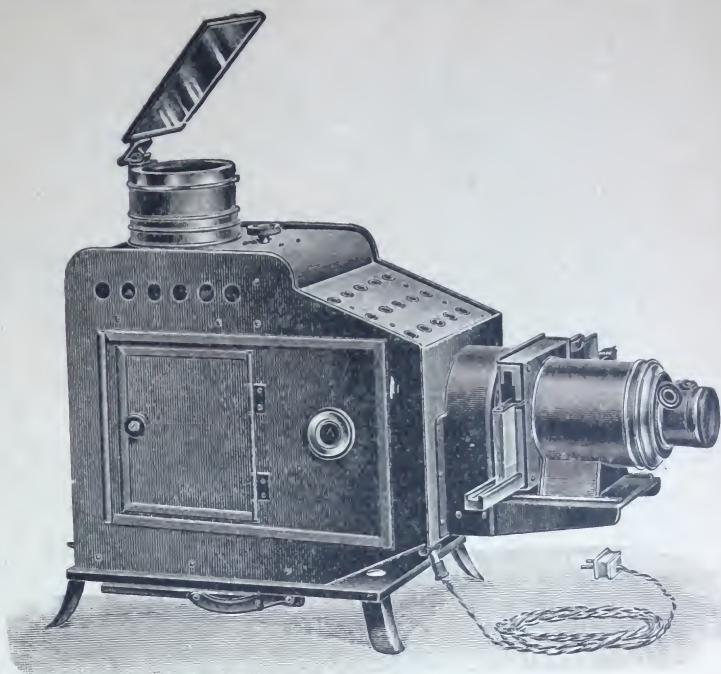
39. 5. 0

82 353. **Cinema Apparatus for Travelling Lecturers, (Illustrated)**, equipped on the same lines as the foregoing, but without the iron column, including instead a tilting under-frame for the apparatus and with two travelling cases, lock-up type, with carrying handles, and iron-bound, containing the whole of the cinema apparatus. Included are two 500 watt tubular lamps, complete **Stopping Gear**, including universal motor, 1/13 HP. suitable for direct and alternating current of 120/220 volts. A screen frame 3×3 m (9,5×9,5 ft.) and a screen are built in

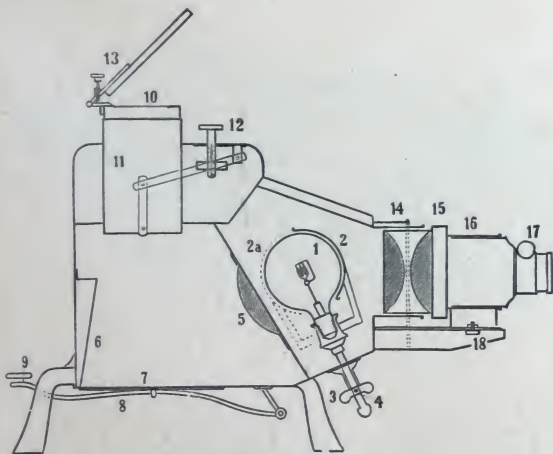
63. 2. 0



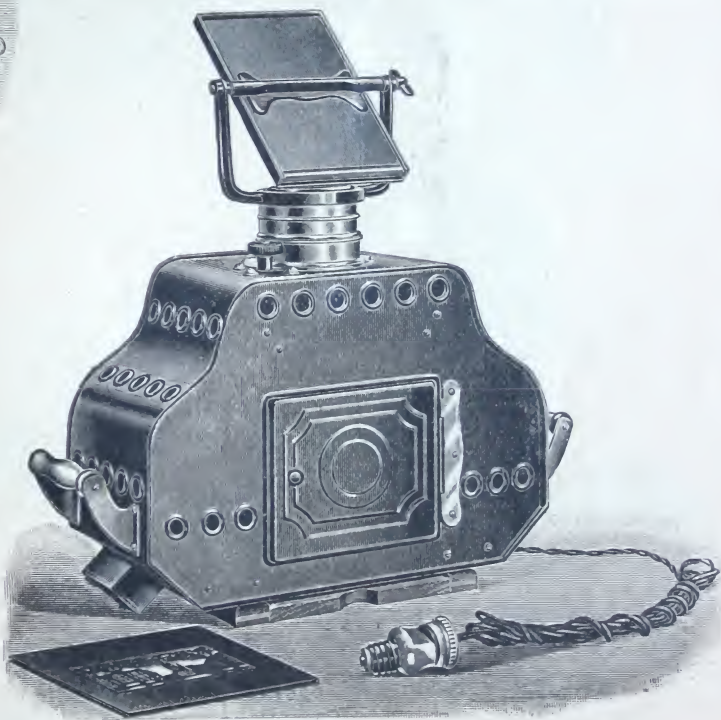
82 354. 1:8.



82 355 A. 1:8.



82 355 B. 1:10.



82 356. 1:8.

82 354. Incandescent Electric Lamp Episcopes for projecting opaque objects such as picture post cards, photos, drawings, book illustrations, etc., coloured pictures in the same colours as the originals. With two 400 watt incandescent lamps for 110 and 220 volts, mirror silvered on front, for pictures 3×3 m ($9\frac{1}{2} \times 9\frac{1}{2}$ ft.). This apparatus can be connected to any lighting supply. It has a Petzval objective of 35 cm focal length (Illustrated).

Model I, with spring base: £ 18. 10. 0. Model II, with ordinary base: £ 14. 15. 0.

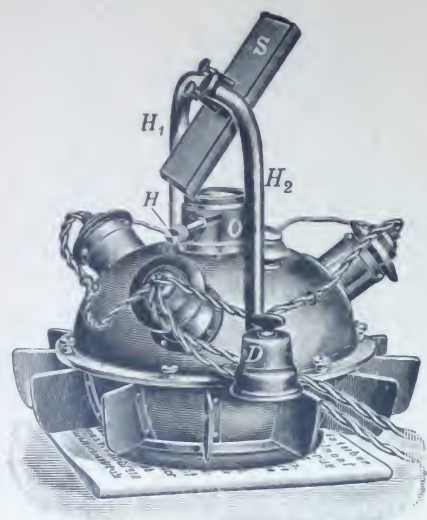
Area lighted: 15×15 cm (abt. 6×6 ins.). Current consumed: 8 amps. at 110 volts, about 4 amps., at 220 volts.

82 355. Incandescent Electric Lamp Episcopes for projecting both opaque objects and lantern slides: with a 400 watt projector glow lamp for 110 volts, with double condenser 115 mm diam., for slides $8\frac{1}{4} \times 8\frac{1}{4}$, and $8\frac{1}{2} \times 10$ cm (Model I), or condenser 150 mm diam. for slides 9×12 cm (Model II), with Petzval objective 35 cm focal length (Illustrated).

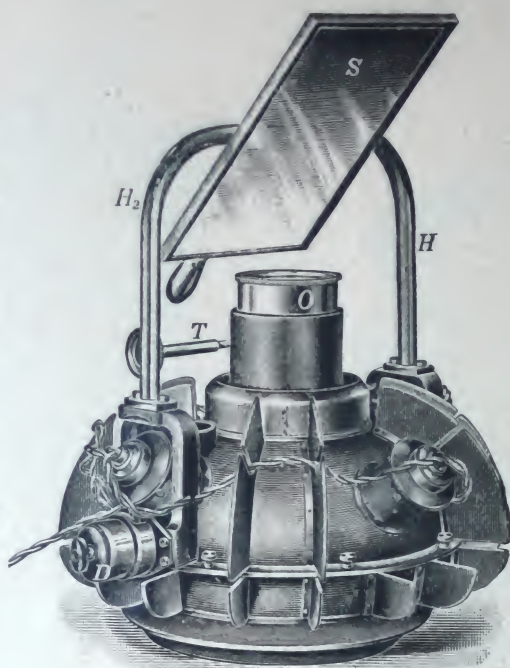
Model I: £ 11. 15. 0. Model II: £ 17. 15. 0

Resistance for connecting to 220 volts Extra 1. 0. 0

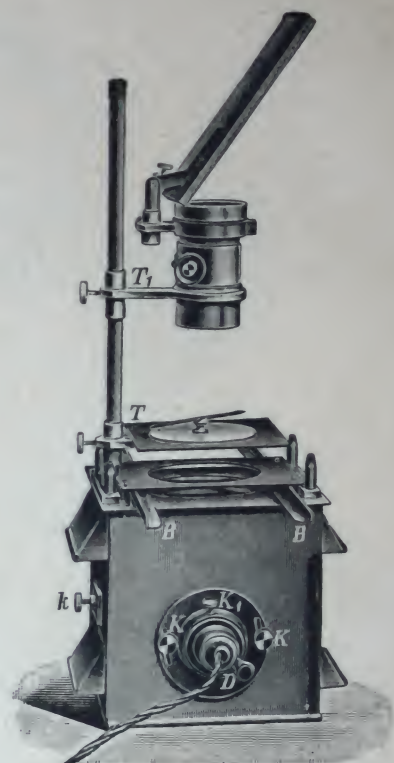
82 356. Mirror Episcopes for projecting opaque objects such as picture post cards, book illustrations, etc., with two 300 watt lamps for 110 and 220 volts, with anastigmat, mirror silvered on front, and total reflexion paper screen $1,5 \times 1,5$ metres ($4,8 \times 4,8$ ft.). Included is 3 metres ($9\frac{1}{2}$ ft.) of flex, with plug and contact (Illustrated). Area lighted, 14×14 cm (about 6×6 ins.) 7. 10. 0



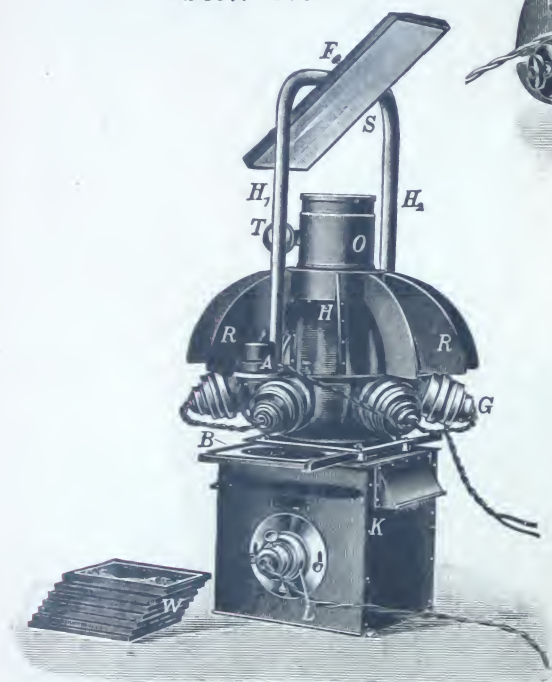
82 357. 1:6.



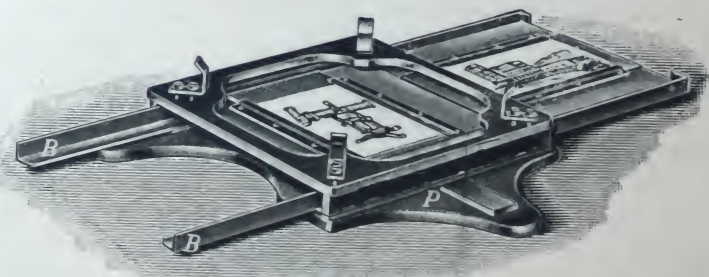
82 358. 1:6.



82 360, 82 361. 1:6.

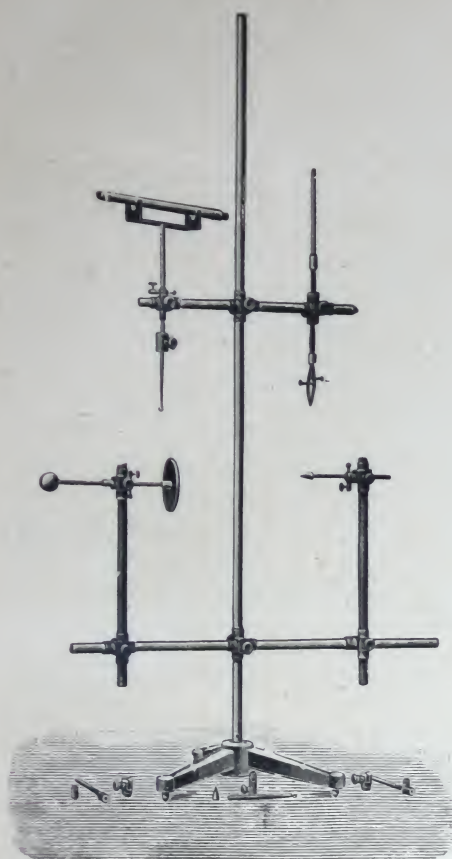


82 359, 82 360. 1:9.

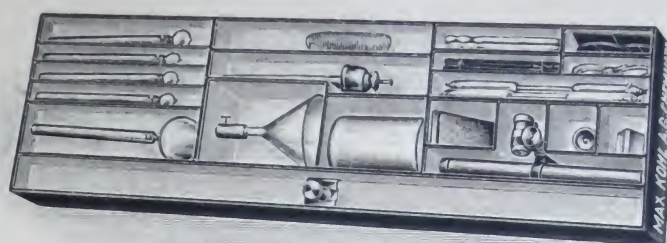


82 362. 1:6.

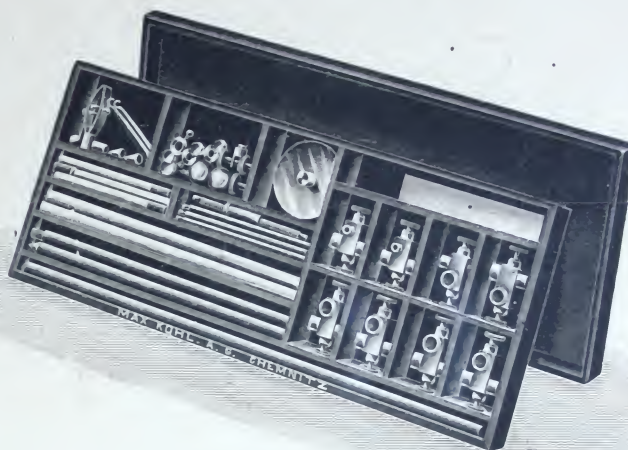
- | | £ | s. | d. |
|---|-----|-----|----|
| 82 357. Spherical Episcopes for projecting opaque objects such as picture post cards, photographs, book illustrations, etc., with simple projection objective, 3 Special Osram Lamps 75 Hefner C. P. (about 67 English C. P.), movable silvered plane mirror in metal mount, with protecting cap, 3 metres (9½ ft.) of twin flex with plug and contact (Illustrated), also dimming switch. Lighted area about 11 cm (4¼ ins.) diam. | 15. | 16. | 0 |
| 82 358. — idem, larger pattern, with 4 Special Osram Lamps 75 Hefner C. P. (67 English C. P.), with finer objective of 27 cm (11 ins.) focal length (Illustrated). Area lighted, about 15 cm (6") diam. | 45. | 0. | 0 |
| 82 359. Diascope Attachment for the Spherical Episcopes, with one Special Osram Lamp for 110, 120 or 220 volts, 4 slides for glass diapositives 8,5×10 and 8,5×8,5 cm, condenser 125 mm (5") diam. (Illustrated) Price without Spherical Episcopes | 11. | 15. | 0 |
| 82 360. Diascope Attachment for the Spherical Episcopes, as No. 82 359, with double condenser of 155 mm (6,1 ins.) diam., and 6 holders or frames for lantern slides 9×12, 8,5×10, and 8,5×8,5 cm (Illustrated) Price without Spherical Episcopes | 15. | 10. | 0 |
| 82 361. Diascope Device for projecting glass slides without using the spherical episcopes. With objective 24 cm (9½ ins.) focal length and reversing mirror (Illustrated) | 23. | 15. | 0 |
| 82 362. Post Card Holder for the spherical episcopes; stand with arrangement for reversing the pictures (Illustrated) | 2. | 16. | 0 |



51100 A. 1:10.



51103 A. 1:9.



51100 B. 1:9.

Apparatus, Supplies and Materials for General Use.

51100. **Physical Work Stand** (Edelmann's), Figures A and B, with case. Regarding the employment of the work stand, see Figure 51103. Price exclusive of the auxiliary parts shown in Figure 51103 (see No. 51103), of iron £ s. d.
4. 0. 0

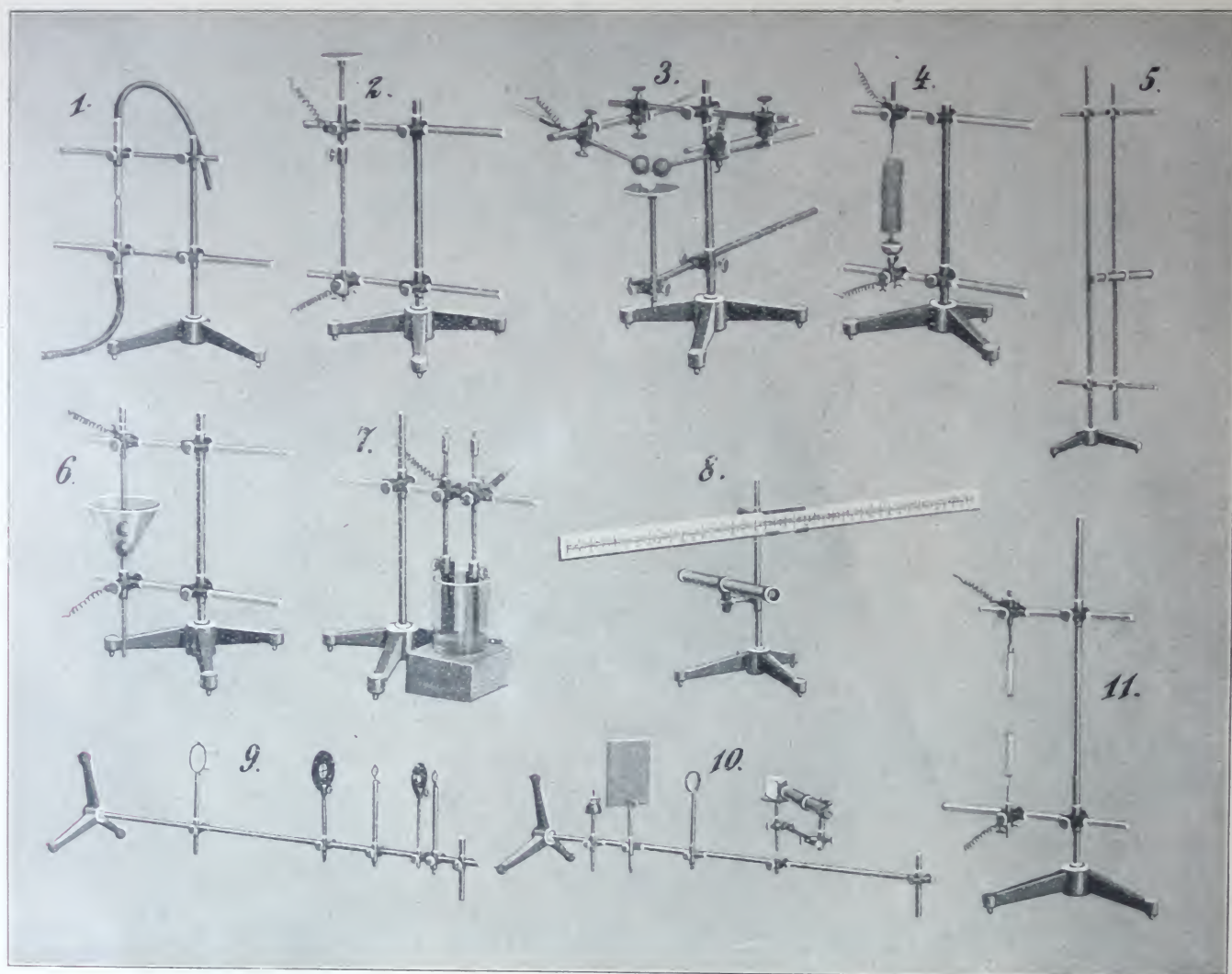
The stand consists of a tripod with pillar, 8 brass cross clamps which can be firmly clamped to the pillar, and some ebonite, glass, iron and brass rods on to which electrodes, terminals, supports, tongs and insulating handles may be screwed. The stand can be placed either vertically or horizontally, and is widely used in physical experiments, e. g., for setting up lenses and prisms and spectrum tubes and for experiments with Leyden jars, induction coils, etc.

51101. — The preceding, of **Brass**, tripod of zinc 4. 10. 0

51102. — The preceding, of **Brass**, with half as many clamps, holders and accessories again as in foregoing 6. 0. 0

51103. **Auxiliary Parts for Edelmann Work Stand**, in accordance with Figures 51103 A and 51103 B, p. 1358.

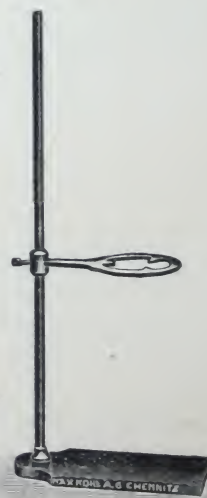
- | | |
|--|----------|
| 1. 2 Glass Tubes for impact pressure of water | 0. 1. 0 |
| 2. 6 Carbon Rods for demonstrating the electric arc | 0. 1. 0 |
| 3. The stand, assembled as a Hentley discharger serves for the ignition of gun-cotton | 0. 0. 0 |
| 4. Roget's Spiral and Bowl | 0. 6. 0 |
| 5. Reading Telescope (see also Fig. 51103, No. 8) | 1. 12. 0 |
| 6. Glass Funnel with metal rod for igniting ether | 0. 2. 0 |
| 7. Glass Vessel with 1 carbon plate, 1 zinc plate and 1 copper plate for making up a cell | 0. 4. 0 |
| 8. Scale for galvanometer readings (Telescope , see No. 5), with holder | 0. 8. 0 |
| 9. 4 Lenses, 2 diaphragms, for making up a Galilean , a terrestrial and an astronomical telescope as well as a microscope | 1. 2. 0 |
| 10. Lamp , slit diaphragm, lens and prism for demonstrating the spectroscope (Telescope , see No. 5) | 0. 10. 0 |
| 11. 2 Spectrum Tubes , with hydrogen and oxygen | 0. 7. 0 |



51100 and 51103 B. 1:9 and 1:14.



51104. 1:10.



51112. 1:8.

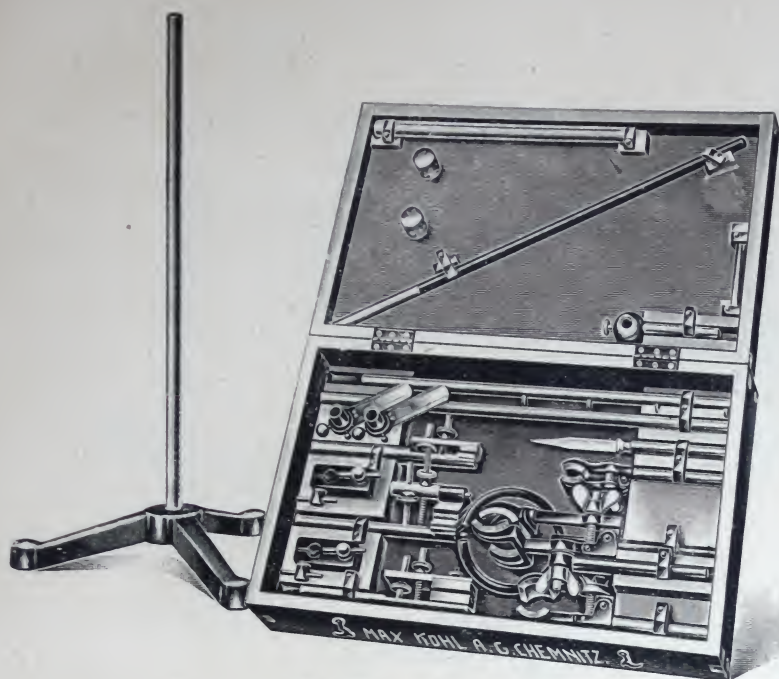
51104. **Universal Stand** (Bunsen's), **massive construction**, on iron foot, Figure (W. D., Fig. 35. — M. T., p. 10), consisting of 1 Iron Stand, 2 Clamps with double sockets, 1 Retort Holder with double socket, 3 Rings with sockets, 1 Fork for carrying Bunsen burner or Berzelius lamp, with socket

£ s. d.
1. 2. 0

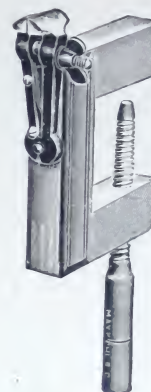
51112, **Boiling Stand**, iron, Figure (W. D., Fig. 34)

0. 3. 6

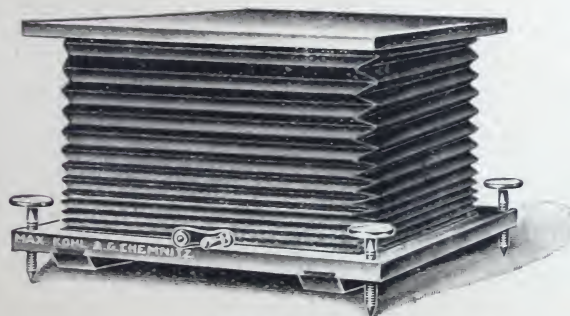
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5955, 5956.



51108. 1:8.



82363. 1:6.



82364. 1:10.



82365. 1:10.

51108. **Precision Work Stand** (Weinhold's) (W. D. pp. 37 and 38, Figs. 38—40), carefully constructed, thus ensuring the accessory parts being accurately and firmly clamped, Figure £ s. d.
3. 10. 0

The stand consists of 1 iron tripod with rod, 2 brass sockets with pressure screws, 1 small clamp with socket, 1 large clamp with socket, 1 retort holder, 1 clamp for cylindrical or prismatic objects (Fig. 39), 1 clamp for conical, wedge-shaped or pyramidal objects (Fig. 40), 3 iron rods of 10, 30 and 50 cm length, 1 box for taking the accessories, 1 ring for funnels, 1 ebonite-rod for Geisslers tubes, 1 rod for suspending thermometers, 1 support to allow of using the stand in horizontal position, 1 clamp for holding tubes and rods, 1 clamp with tongs.

82363. **Adjustable Clamp**, with filing Vice, Figure 0. 4. 0

82364. **Adjustable Support**, Figure (Ztschr. f. phys. u. chem. U. **24**, 1911, p. 194). This is a very useful adjunct enabling apparatus to be placed at any convenient height above the lecture table 4. 15. 0

By manipulating the handle the top table of the device (and the piece of apparatus on it) can be raised and lowered fractions of a millimetre. Maximum travel, about 20 ins.

82365. **Gas-Heated Distilling Apparatus**, of best construction, Figure, comprising tinned copper still holding 2,2 gallons of water, with detachable top held to the brass wheels by screw clamps. The cooling vessel, of tinned copper, contains a tin cooling coil. A gas burner is supplied with the apparatus. 8. 10. 0



51 244 - 51 249. 1:10.



82 366. 1:9.



51 284. 1:11.



82 367. 1:14.



82 368. 1:14.



51 370. 1:14.

Calibrated Glass Bells for measuring gas volumes (M. T., Fig. 5), with clamping rings, Figure, £ s. d.
without glass receiving cylinders.

List No.	51 244 a	51 245 a	51 246 a	51 247 a	51 248 a	51 249 a
Capacity ccm	100	250	500	1000	1500	2000
Size about mm	220×30	280×40	360×55	450×65	470×75	500×80
Price, each £	0. 7. 0	0. 8. 0	0. 9. 6	0. 12. 0	0. 14. 0	0. 16. 0

Glass Receiving Cylinder: List No 51 244 b 51 245 b 51 246 b 51 247 b 51 248 b 51 249 b
Price, each: £ 0. 0. 10 0. 1. 0 0. 1. 10 0. 3. 6 0. 5. 0 0. 8. 0

51 284. **Hydrogen Generating Apparatus**, Figure, consisting of 2 tubulated flasks, rubber hose, drying bulb with stopcock and adjustable stage. The apparatus can be connected direct to the burner 0. 18. 0

82 366. **Glass Bottle** for storing distilled water, with lacquered iron wall bracket, Figure. The bottle is fitted with a ground glass tap underneath, and a glass stopper on top. It holds about 3,3 gallons of water 1. 8. 6

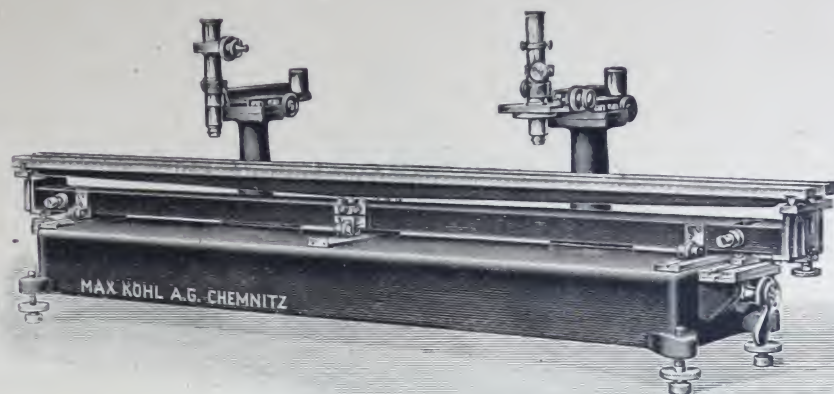
82 367. **Powder Jars** with wide neck, Figure, with grips or flat stoppers of white glass. Price, unfilled: 150 200 300 400 500 1000 ccm capacity
a) With Grips 3 s. 8 d. 4 s. 3 d. 5 s. 5 d. 5 s. 10 d. 6 s. 6 d. 10 s. per 10
b) With Flat Stoppers 3 s. 8 d. 4 s. 3 d. 5 s. 5 d. 5 s. 10 d. 6 s. 6 d. 10 s. per 10.
If without stoppers the bottles cost about half the price.

82 368. **Bottles for Liquids**, with narrow necks, with tall or squat stoppers, Figure, of white glass. Price, empty: 150 200 300 400 500 1000 ccm capacity
a) With Grips 3 s. 3 d. 3 s. 6 d. 4 s. 10 d. 5 s. 4 d. 6 s. 7 s. 6 d. per 10
b) With Flat Stoppers 3 s. 3 d. 3 s. 6 d. 4 s. 10 d. 5 s. 4 d. 6 s. 7 s. 6 d. per 10.

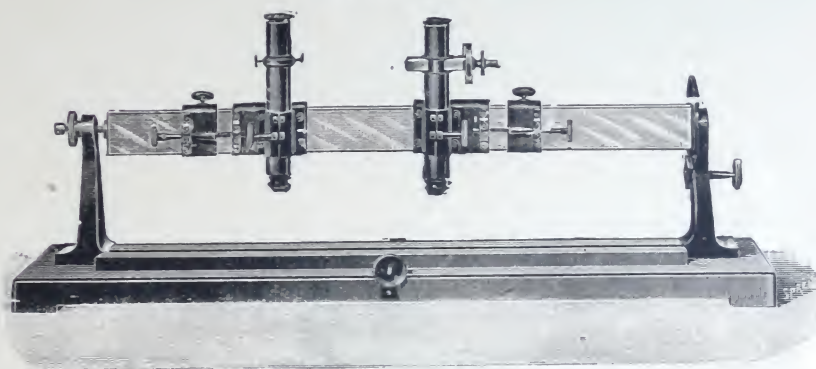
51 370. **Bottles for Reagents or Powders**, with enamel labels, burnt-in black or etched inscriptions, with tall or squat stoppers and wide or narrow openings, Figure.

100	150	200	300	400	500	1000
grams capacity	grams capacity	grams capacity	grams capacity	grams capacity	grams capacity	grams capacity
1 s. 1 d.	1 s. 2 1/2 d.	1 s. 3 1/2 d.	1 s. 5 d.	1 s. 6 1/2 d.	1 s. 8 1/2 d.	2 s. 1 d. each.

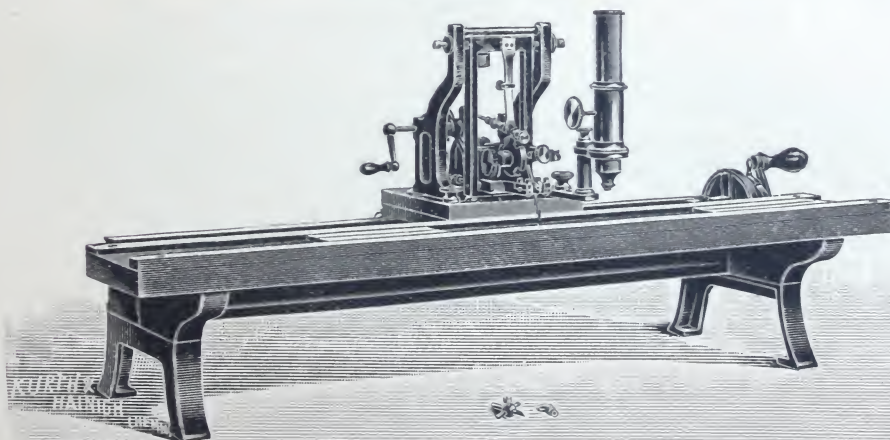
Prices 10% extra for brown or blue glass bottles.



51 467. 1:14.



51 468. 1:8.



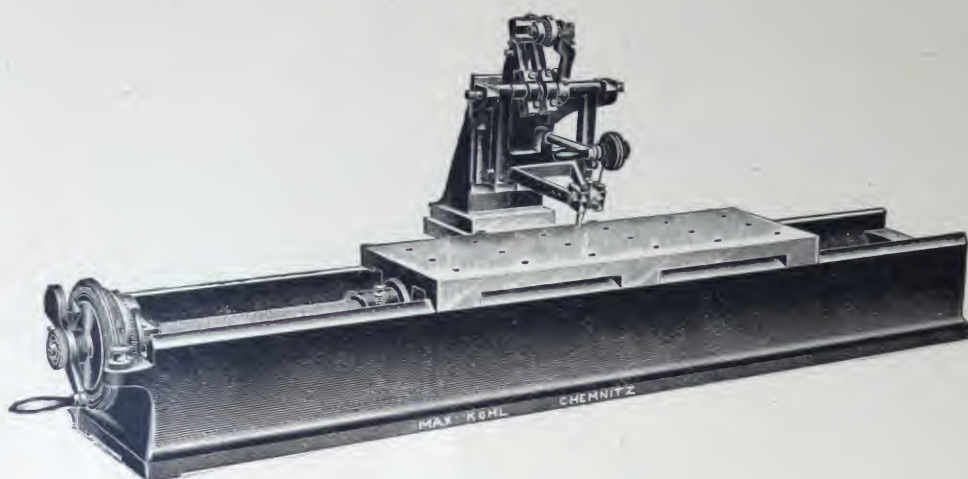
51 478. 1:8.

Comparators, Longitudinal- and Circle Dividing Engines.

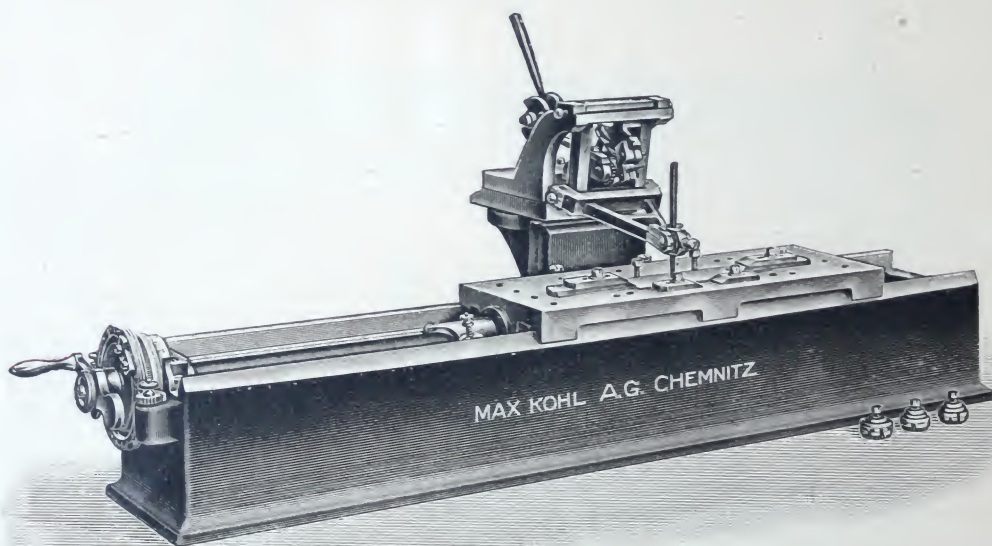
Comparators and Longitudinal Dividing Engines.

	£	s.	d.
51 467. Comparator for rules divided with lines, Figure	47.	10.	0
Lengths up to 1 m can be compared with this instrument. It consists of an iron bench, and two reading microscopes can be moved along the entire length of this bench, being also capable of lateral motion. One microscope has a micrometer eyepieces with movable line, the other a Fraunhofer micrometer.			
The bench is fitted with a table capable of lateral motion and upon which the strips, fitted with knife-edges rest. These strips contain the scales that are to be compared. The supports of the strips can be adjusted vertically by micrometer screws.			
51 468. Apparatus for Calibrating and Testing Thermometers (Comparators) , Figure	17.	10.	0
Two micrometrically adjustable reading microscopes can be moved along the length of a horizontal rail.			
51 478. Dividing Engine for lengths to 500 mm, carefully and massively constructed, Figure.	25.	0.	0
with screw of 1 mm pitch, arrangement on the drawing mechanism for drawing the 5 th s and 10 th s longer, and with reading microscope			
The illustration does not now represent the drawing mechanism, this having been considerably improved.			

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425,
3773.

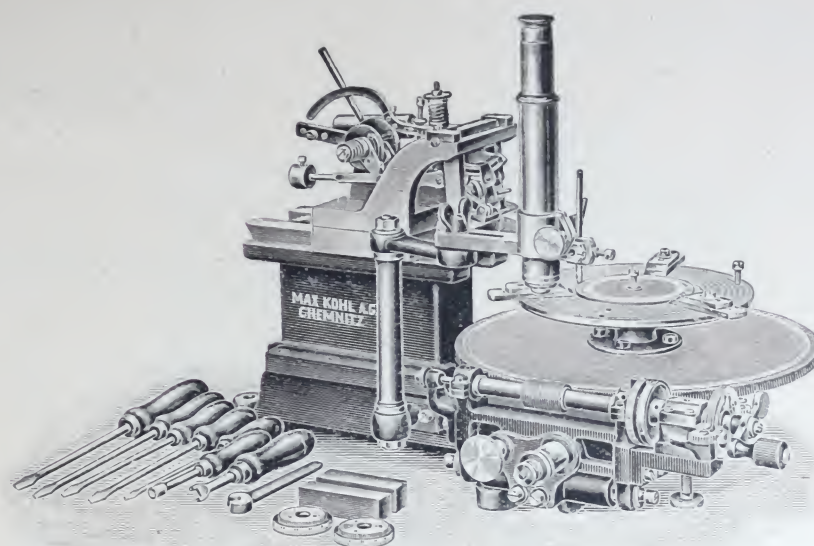


51 480, 51 480 a. 1:7.

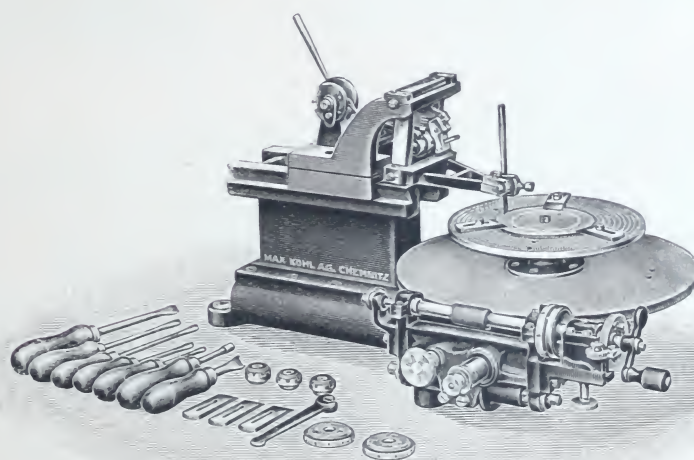


82 369, 82 369 a. 1:7.

51480. Longitudinal Dividing Engine for fine and coarse graduation, Figure, for lengths to 350 mm, total length of machine 850 mm (Fr. phys. Techn. I, 1, Fig. 1963).	£ s. d.
This machine divides accurately to $\frac{1}{200}$ mm by means of a dividing wheel and a screw with millimetre pitch; the drawing mechanism rests firmly on the powerful cheeks and permits of the mechanical drawing of graduations of various lengths. For reading microscope for this engine, see No. 82369 b.	32.10.0
51480 a. — idem, for lengths to 500 mm, total length of machine 1,25 m	37.10.0
82369. Longitudinal Fine Dividing Engine, Figure, for lengths up to 350 mm ($13\frac{1}{2}$ ins.). Total length of the engine 850 mm (about $33\frac{1}{2}$ "), with improved cutting frame having automatic lifting gear. Description	35. 0.0
82369 a. — idem, for lengths up to 500 mm ($19\frac{1}{2}$ "). Total length of the engine, 1,25 m (abt. 4 ft.)	40. 0.0
The cutting frame of these engines 82369, 82369 a can be easily removed and replaced by two micrometer microscopes travelling over the whole length of the engine. This arrangement enables the engines to be used as comparators.	
Extra for fitting with two micrometer microscopes, one with Fraunhofer adjustable cross-wires	15. 0.0
82369 b. Reading Microscope on slider, with stand and holder	3.15.0



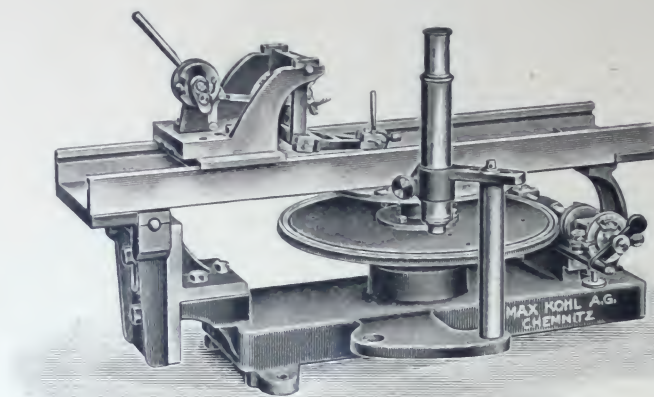
51484. 1:6.



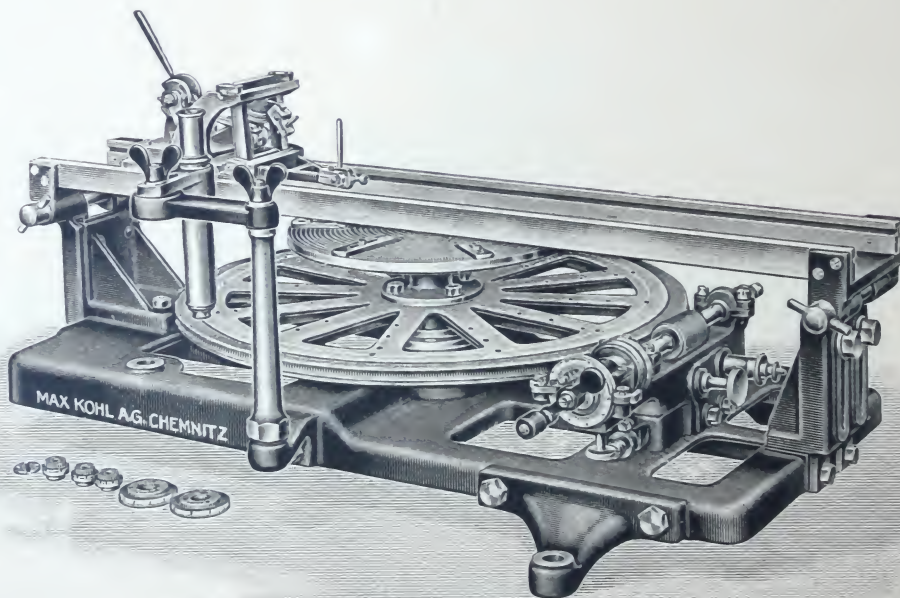
51485. 1:8.

Circle Dividing Engines.

51484. Circle Dividing Engine , Figure, with plate 250 mm diameter, graduated on silver in $\frac{1}{6}^0$ and graduations for the verniers, tangential screw and dividing drum, with Microscope, cutting frame with automatic lifting-gear, special arranged for silver graduations	£ s. d. 46. 5.0
51484a. — idem, with plate 300 mm diameter	48.15.0
51485. Circle Dividing Engine , Figure, with plate 250 mm diameter, graduated on brass in $\frac{1}{2}^0$, without microscope. Description	37.10.0
The circle is divided into 720 parts and has a tangent screw; one complete turn of this corresponds to $\frac{1}{2}^0$.	
51485a. — idem, with plate 300 mm diameter	40. 0.0
51487. Small Circle Dividing Engine , for rapidly making graduations for which too great an accuracy is not necessary	25. 0.0
The brass plate, 250 mm in diameter, has a point-alidade of 360 and 400 points bored in so as to be firmly held in any position.	

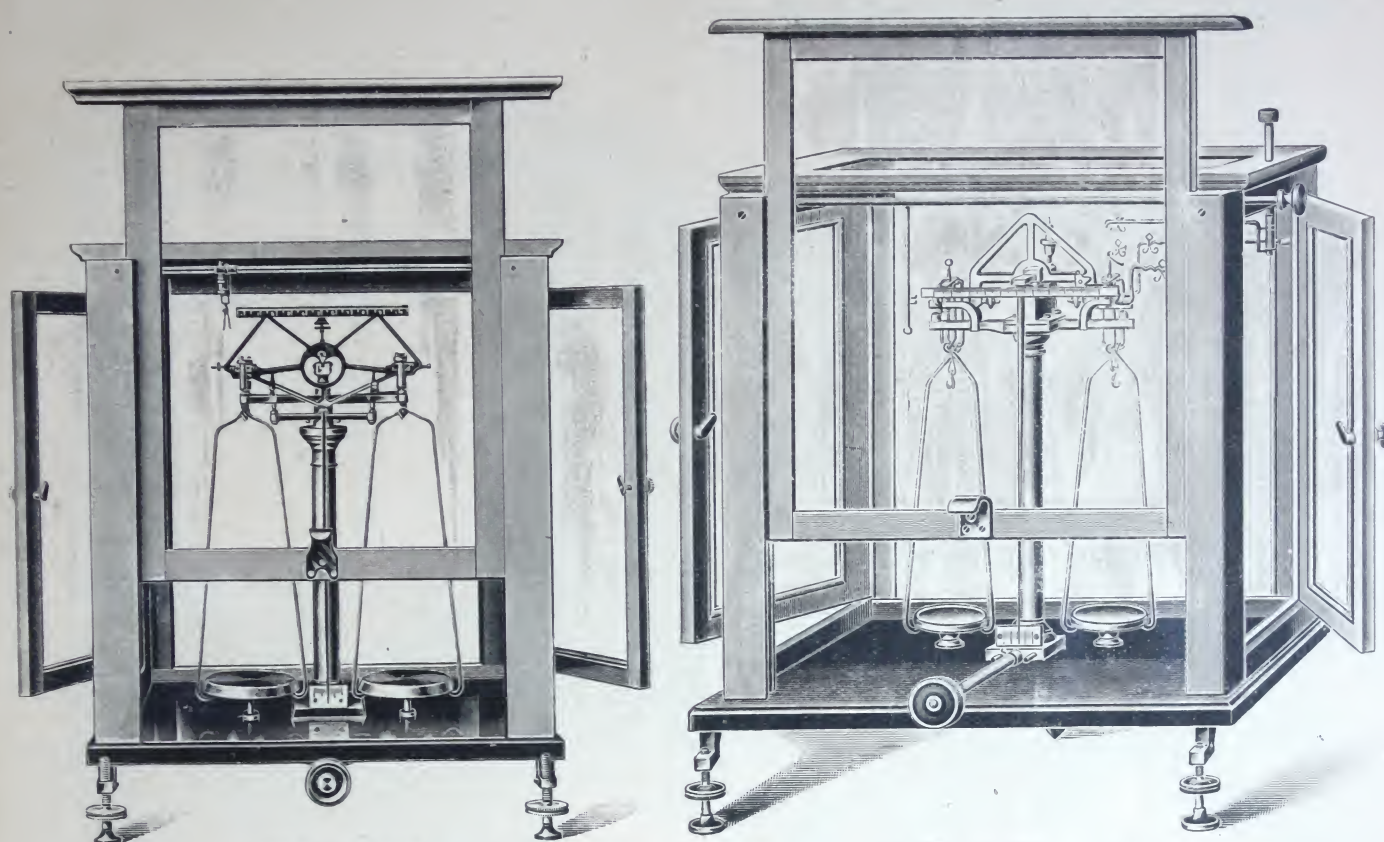


82370, 82371. 1:8.



82372. 1:8.

82370. Circular Dividing Engine, with cutting frame fitted on a beam placed above the engine, and adjustable along this, to enable graduations to be cut on inclined surfaces as well. With graduations on brass in $1/2^\circ$, with plate 300 mm (12") diameter, Figure; without Microscope	£ s. d.
Extra Price for microscope with holder	40. 0.0
82371. — idem, with graduations on silver in $1/6^\circ$; plate diameter 300 mm (12"); without Microscope, Figure	2. 10.0
82372. — idem, larger and strong design, with plate 550 mm (23") in diameter; graduations on brass in $1/2^\circ$, Figure; without Microscope	55. 0.0
Extra Price for microscope, stand and ball-and-socket joint	60. 0.0
	3. 15.0



82 373—82 376. 1:6.

82 377—82 384. 1:6.

Balances and Sets of Weights.

Chemistry Analytical Balances.

Analytical Balance with beam of hard-rolled sheet aluminium or gilt phosphor bronze, Figure. The design of the beam ensures perfect rigidity. **Axes and bearings of agate.** Axis correcting device and compensated suspension. Pans platinised or heavily gilt. The beam and suspension are arrested in succession. **Patent Rider Displacing Gear.** The balance is mounted in a highly polished mahogany case, glazed, with balanced front shutter and side doors, and rests on a black plate-glass base. This balance combines the latest improvements with absolute accuracy.

List No.	82 373	82 374	82 375	82 376
To carry grams	100	200	500	1000
Sensitivity mg	0,04	0,05	0,1	0,15
Price £	12.0.0	13.0.0	16.0.0	20.0.0

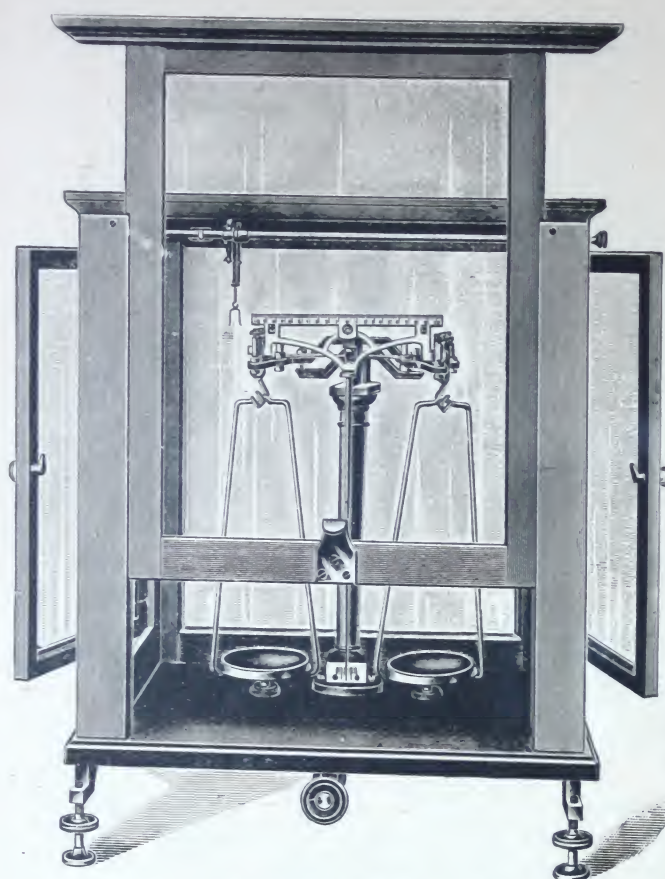
Prices without Rider Weights. For Rider Weights and Sets of Weights, see pp. 1368, 1379—1382.

Analytical Balance with short-armed triangular Aluminium Beam and quick oscillating tongue, Figure, with round heavily nickel-plated brass column, with arrestment for beam and suspension and device for shifting the rider when the case is closed. Agate bearings, pans gilt or platinised; mahogany and glass case. Front sliding door with counterweights, and two side doors. On dead black plate-glass base.

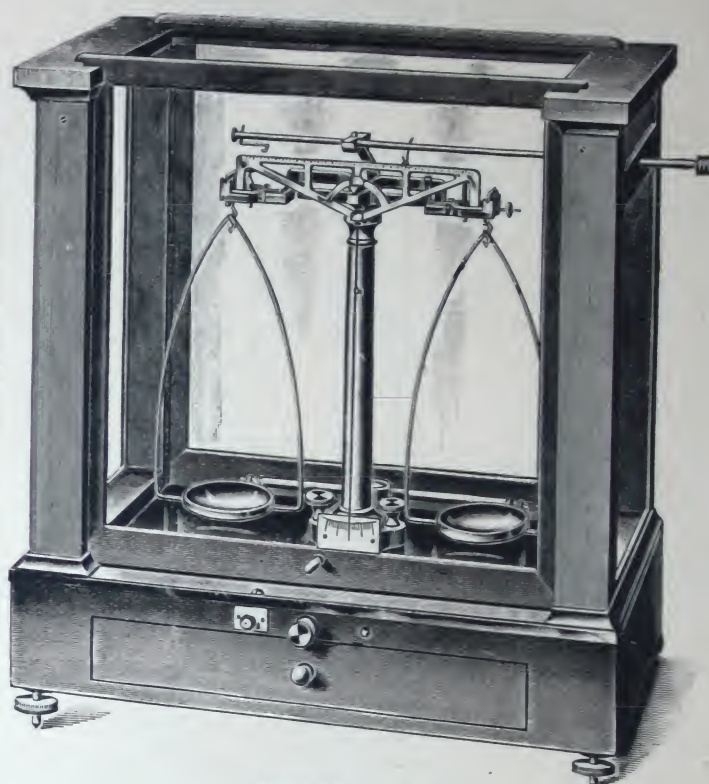
List No.	82 377	82 378	82 379	82 380
To carry grams	5	50	200	1000
Pan diameter mm	35	50	80	110
Sensitivity mg	0,02	0,05	0,1	0,2
Price with gilt steel axes £	7.15.0	9.0.0	11.0.0	13.5.0

List No.	82 381	82 382	82 383	82 384
Price with agate axes £	8.5.0	9.10.0	11.15.0	14.0.0

Prices without Rider Weights. For Rider Weights and Sets of Weights, see pp. 1368, 1379—1382.



82 385—82 388. 1:6.



82 393. 1:5.

Analytical Balance, Figure, with yellow lacquered brass column, with three releases, viz., for beam, suspension, and pans. Compensated suspension; arc arrestment and axial correction. The straight short-armed beam, forming at the same time the rider scale divided into 200 parts, is made of well gilt hard brass or magnalium. **Axes and bearings are agate.** Pans are gilt or platinised. **The balance is also fitted with Patent movement for the rider which enables the latter to be lifted exactly at right angles and renders it impossible for it to drop down again.** The highly polished mahogany case has a balanced front sliding door, side doors, levelling screws with supports, and is mounted on a black plate-glass base:

	List No. 82 385	82 386	82 387	82 388
To carry grams	100	200	500	1000
Length of beam cm	12	14	16	19
Pan diameter mm	65	80	100	120
Sensitivity mg	0,1	0,1	0,15	0,2
Price £	8.15.0	9.5.0	10.5.0	12.15.0

Prices without Rider Weights. For Rider Weights and Sets of Weights, see pp. 1368, 1379—1382.

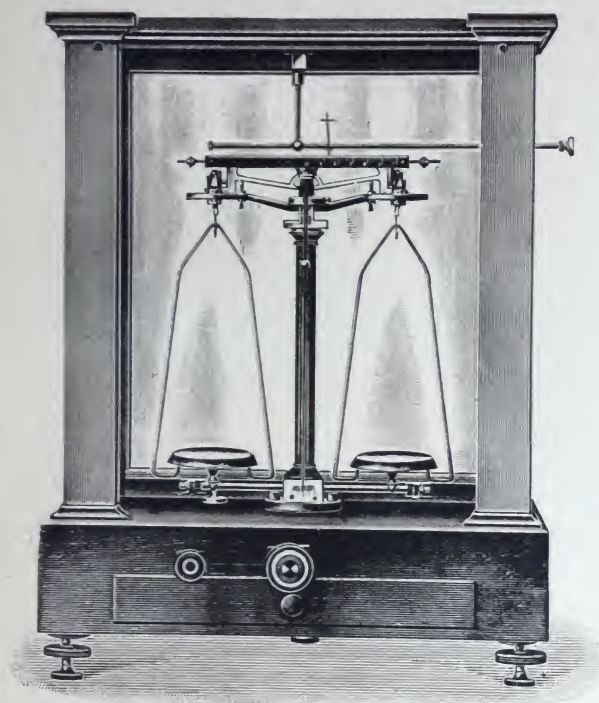
— idem, simple, with black burnished column and yellow lacquered beam, in glass case without side doors.

	List No. 82 389	82 390	82 391	82 392
To carry grams	100	200	500	1000
Sensitivity mg	0,1	0,1	0,15	0,2
Price £	7.15.0	8.5.0	9.0.0	11.5.0

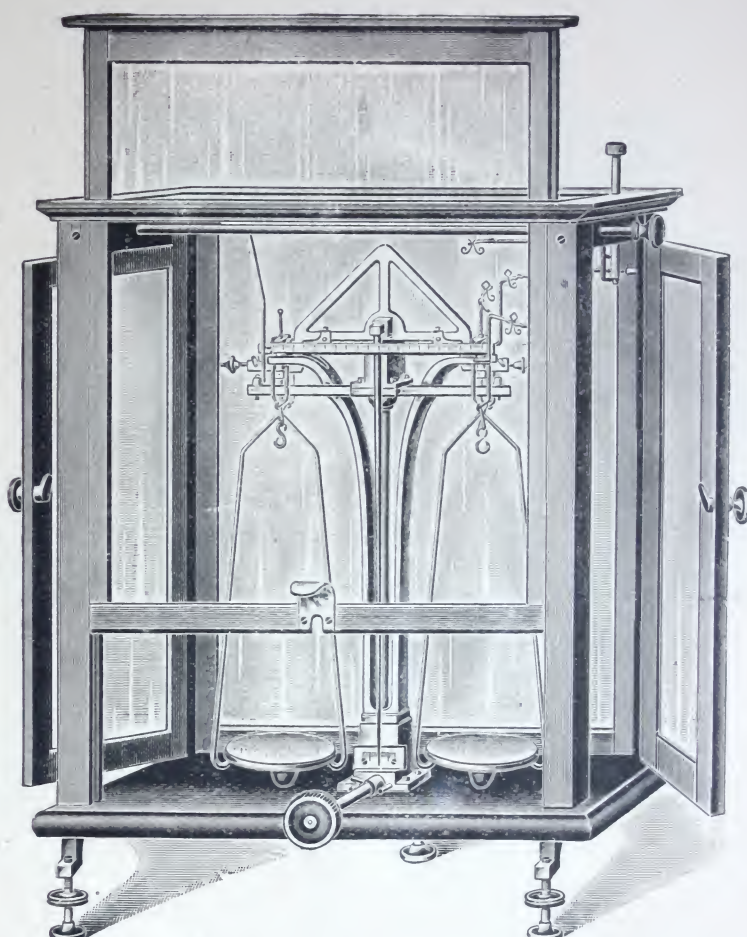
82 393. **Analytical Balance, Figure,** with quick-swinging beam of aluminium or hard rolled sheet-brass, heavily gilt. The top edge of the beam, graduated, is for the use of 10 mg riders. **Agate axes and bearings,** with triple release for beam, suspension and pans. Release for pans by special gear. **Rider Displacing Gear.** Pans gilt or platinised. The balance is mounted in a highly polished mahogany and glass case, with balanced sliding door (front), back door, black plate-glass base and bottom box with drawer. Capacity 200 g, sensitivity $\frac{1}{20}$ mg £ s. d.

12. 15. 0

Prices without Rider Weights. For Rider Weights and Sets of Weights, see pp. 1368, 1379—1382.



82394. 1:9.



51531a-51538a. 1:5.

82394. **Analytical Balance**, Figure, aluminium beam, graduated, suitable for 6 mg riders, with agate axes and bearings, triple release for beam, suspension and pans. Release for pans by special gear. **Rider Displacing Gear**. The balance is mounted in a highly polished mahogany case with balanced sliding door (front), back door, on bottom box with drawer. Capacity 100 g, sensitivity $\frac{1}{20}$ mg £ s. d. 7.10.0

82395. — idem, but without release for suspension and without back sliding door. Capacity 100 g, sensitivity $\frac{1}{10}$ mg 6.10.0

Prices without Rider Weights. For Rider Weights and Sets of Weights, see pp. 1368, 1379-1382.

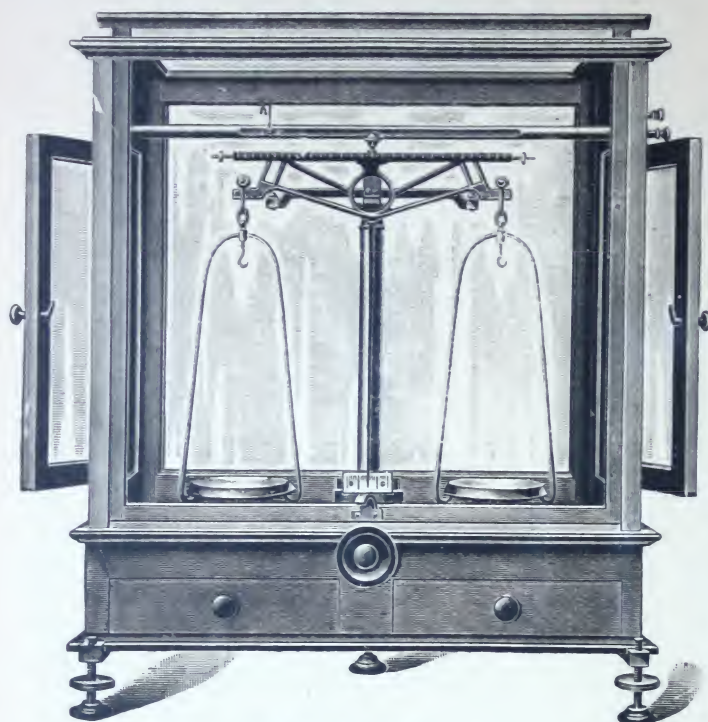
Analytical Balance, also suitable for specific gravity determinations, Figure, with agate bearings, gilt or platinised pans, mahogany-glass case with front sliding door with counterweights, and two side doors, aluminium beam with quick-swing pointer, heavily nickel-plated brass stand on black plate-glass base, with rider slide when case is closed.

List No.	51531a	51532a	51533a	51534a
To carry grams	5	50	200	1000
Pan diameter mm	35	50	80	110
Sensitivity mg	0,1	0,1	0,2	1
Price £	6.5.0	7.5.0	8.5.0	10.15.0

Prices without Rider Weights. For Rider Weights and Sets of Weights, see pp. 1368, 1379-1382.

— idem, without iron or steel parts, agate axes.

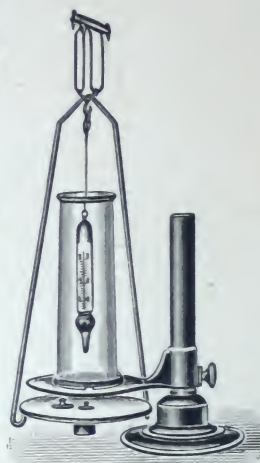
List No.	51535a	51536a	51537a	51538a
To carry grams	5	50	200	1000
Sensitivity mg	0,1	0,1	0,2	1
Price £	6.15.0	7.15.0	9.0.0	11.10.0



82 396—82 399. 1:6.



51 637. 1:3.



51 578. 1:5.



82 400. 1:2.



82 401. 1:2.

Analytical Balance with half-length beam of best hard brass, highly polished and lacquered, with two releases, viz., for beam and pans. **Agate bearings** and highly gilt steel axes. **End axes adjustable.** The pans are highly platinised, and all other parts of the balance lacquered. The glass case is of highly polished mahogany, with adjustable front sliding door and side doors, on support with two drawers. Displacing mechanism for the riders, plummet, levelling screws and supporting discs., Figure.

	List No. 82 396	82 397	82 398	82 399
To carry grams	50	100	200	500
Pan diameter cm	7	8	9	10
Sensitivity mg	0,2	0,2	0,3	0,5
Price £	5.15 0	6.10.0	7.5.0	8.5.0

Prices without Rider Weights. For Sets of Weights, see pp. 1379—1382.

Accessories.

51 637. **Rider Weights**, Figure, of aluminium, in dull walnut case with forceps, containing 9 aluminium riders from 10 to 500 mg, for the rider slides of the analytical balances Nos. 82 373—82 399, 51 531a—51 538a. The rider weights can easily be recognised one from the other by the number of the rings; the 10 and 100 mg have each one ring underneath on each side; the 20 and 200 mg have each two rings, and the 50 and 500 mg each 5 rings. Case with 9 riders and forceps

0. 6. 0

51 578. **Outfit for Specific Gravity Determinations** on liquids and solids, for analytical balances Nos. 51 533a, 51 534a and 51 537a, 51 538a. Figure, owing to the height of the pans this outfit can only be used for the balances to carry 200 grams and 1 kg

0. 10. 0

1 Reimann Thermometer, 15 g weight, displaces 5 g distilled water at 15° C., 1 adjustable stage for the glass jar (M. T., p. 103), 1 counterpoise each of 10 and 5 grams, 1 glass plummet.

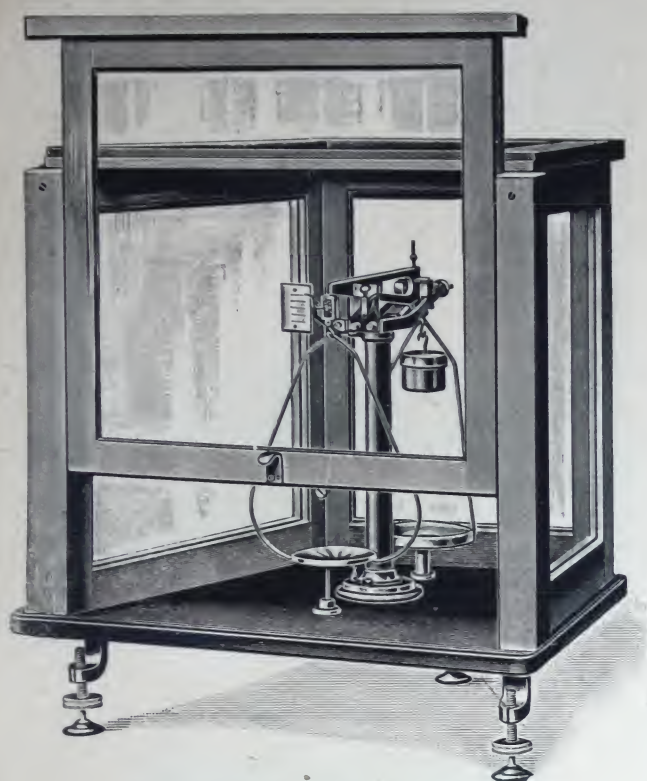
82 400. **Cross Level**, round form, nickel-plated, Figure

0. 3. 0

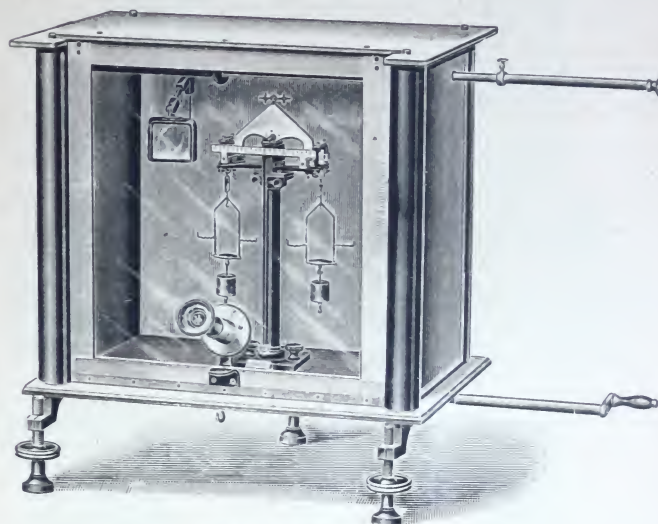
82 401. **Longitudinal Level**, nickel-plated, about 3" long, Figure

0. 3. 0

Cl. 5491,
7256,
7255, 5492, 7257,



51 567. 1:6.



82 402. 1:8.

Precision, Micro and Assay Balances.

- 51 567. **Decimal Rapid Action Balance** (Dr. Mach's). The high sensitivity of the quick-swinging balance remains constant even when used for very quick work. The balance has **agate bearings** and is mounted in a polished glass case with balanced sliding window and levelling screws. Capacity, 100 grams; sensitive to 1 milligram. Figure £ s. d.
5.10.0

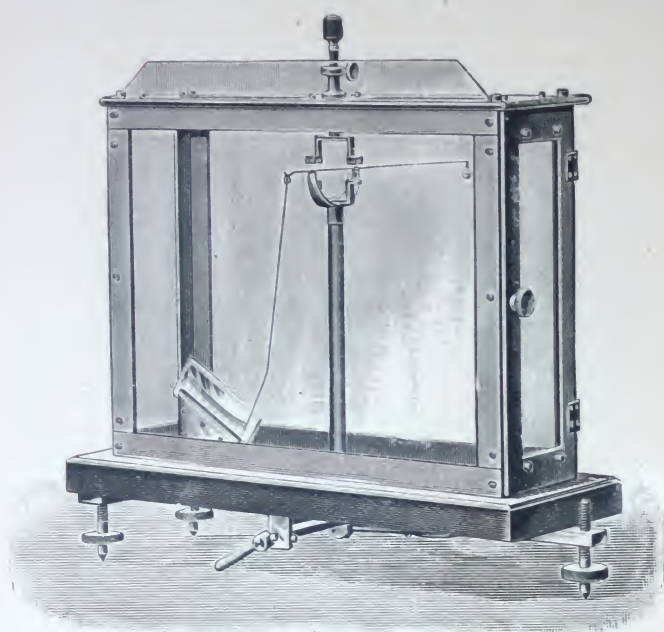
This balance, based on the principle of the inverted decimal balance, has **complete and independent arrestment for the pans**, together with **steadying device**, thus enabling rapid weighings to be done without impairing the accuracy. The aluminium beam of the long-armed type has the pan at one end for containing the substance to be weighed, while the shorter arm contains the weight pan and the taring cap. The suspension of the weight pan is fitted with an arrangement which, when the balance is at rest, automatically unloads the knife-edge. The steadying spring fitted under the pan prevents any oscillation taking place. The suspension on the lower arm of the beam only bears on the end knife-edge when the weight placed in the pan on the longer arm of the beam is $\frac{1}{10}$ or more of the weight in the weight-pan. Weighing boats, which can be calibrated by means of the tare or calibrating device, can therefore be filled with the desired substance until the scale deflection shows that $\frac{1}{10}$ th of the weight in the other pan has been reached. **The arrestment requires no manipulation**, so that both hands are free for the other operations, thus enabling weighings of the same quantities to be carried out **quickly and accurately**.

- 82 402. **Micro-Chemical Analytical Balance**, Figure, with **Microscope** and **small calibrating beakers**, and a set of 9 accurately adjusted rider weights from 5—100 milligrams and three riders of 5 mg each for the scale; 4 small aluminium beakers (1 gram in weight), two attachments for suspending the weights and riders, two suspending wires, 20 cm of aluminium wire $1\frac{1}{2}$ mm diameter. Carries 40 grams. 15.10.0

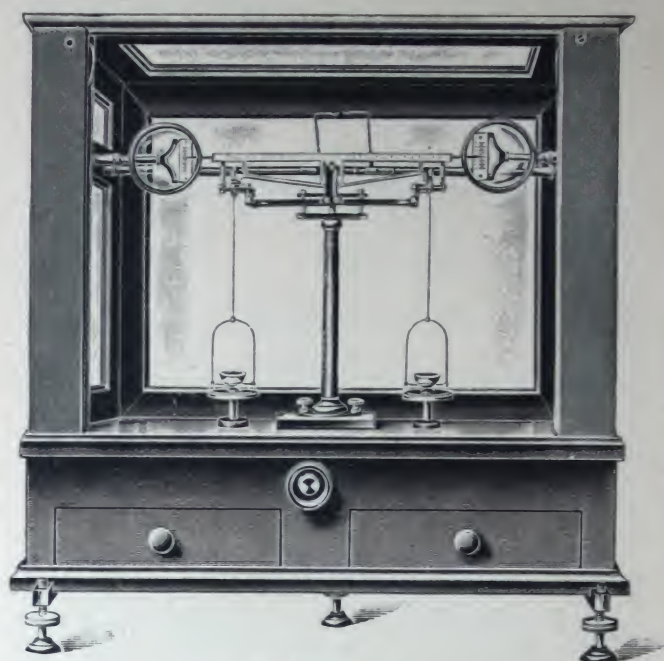
The balance beam is constructed of light alloy and is protected from heat rays by an aluminium plate. The adjusting wing nuts for setting the balance to zero are easily accessible, being fitted at the point of the beam, and are manipulated quite independently of the sensitive adjustment fitted underneath. The balance is fitted with **two scales**, one being **movable for the microscope crosswires**, and the one underneath this, visible and fixed, **for the end of the pointer**. To prevent the adjustment of the crosswires being displaced relatively to the zero point, the position of the front slide is secured by two taper pins. The sharp-edged rider scale, of German silver, has 100 accurately calibrated notches. The balance is in equilibrium when the 5 mg rider is in the first notch on the left. Displacing this one notch to the right represents $\frac{1}{10}$ mg and causes a deflection of 10 whole scale divisions on the scale visible in the microscope, so that whole milligrams (up to 10 mg) and $\frac{1}{10}$ ths of milligrams are read off on the scale by means of a magnifying glass, and $\frac{1}{100}$ ths of milligrams in the microscope. Thousandths of milligrams can be readily estimated due to the uniform and practically undamped swing of the beam.

The **base-plate and case** of the balance are made entirely of **aluminium** so as to prevent thermal effects: only the **front sliding door** being fitted with a **glass plate**. For the same reason, the arrestment and rider displacing mechanism are fitted with lengthening pieces and the right hand side of the case is double-walled. The usual type of pans are replaced by small stirrups, and all attachments are used for the purpose of rider weights. Small tare (calibrating) beakers can be placed between or under the stirrups.

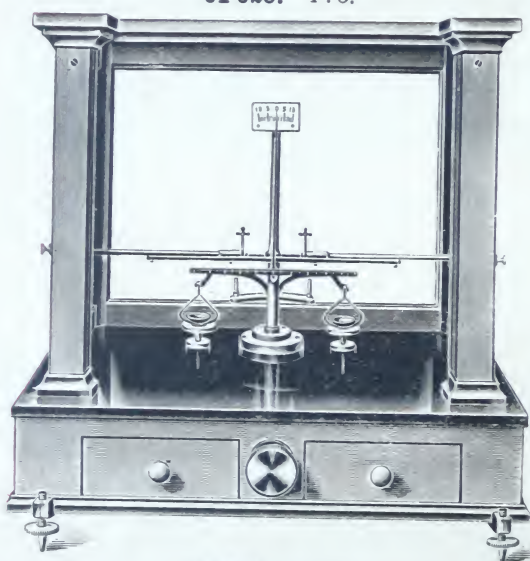
- 82 402a. — idem, but in polished mahogany and glass case instead of a metal case 13. 0.0
82 402b. **1 Pair of Stirrups with Pans**, to enable the balance to be used as an assay or analytical balance 1. 5.0



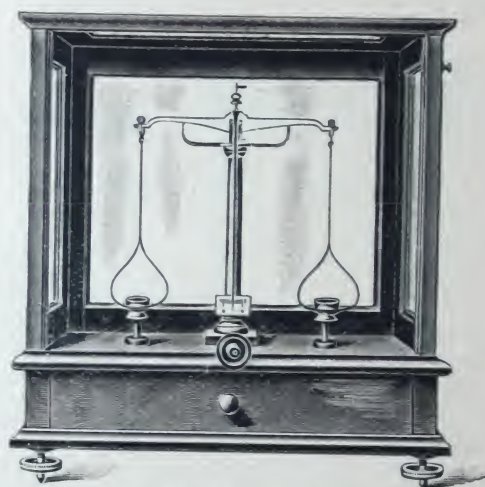
51 528. 1:3.



82 403. 1:5.

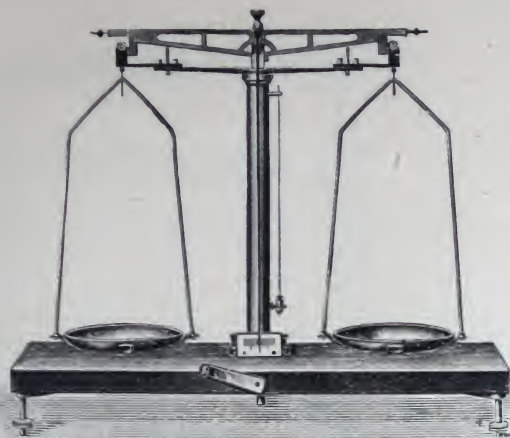


82 404. 1:5.

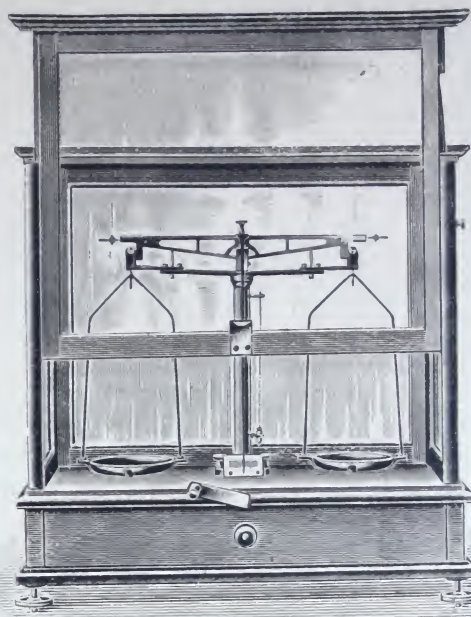


82 405. 1:5.

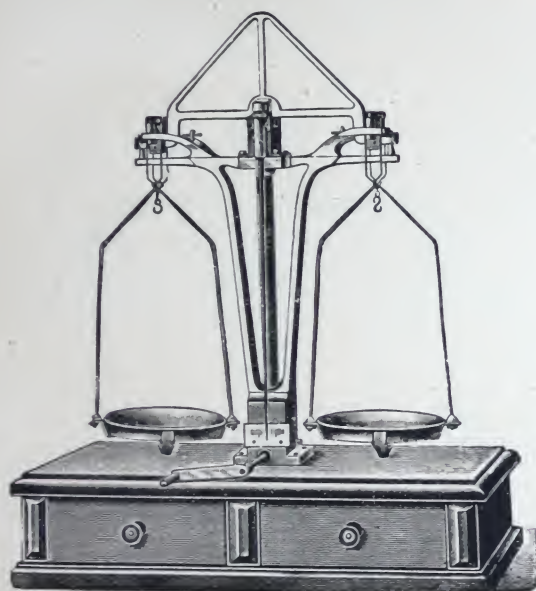
- 51 528. **Micro-Balance**, Nernst's, Figure, a torsion balance for weights to 2 milligrams and for an accuracy of $\frac{1}{1000}$ to $\frac{2}{1000}$ milligrams. (Berichte der Deutschen Chemischen Gesellschaft, 36, No. 10, and 38, No. 1. — Fr. physik. Techn. 1, 2, Fig. 2251) £ s. d.
6. 5. 0
- 82 403. **Assay Balance**, of excellent design and finish and maximum sensitivity, with aluminium beam, both ends of which are fitted with indicating points. Adjustable **achromatic** magnifying lenses in front of both scales give very accurate and undistorted images and enable weighings to be read off quickly and accurately. **Agate axes and bearings; 1 pair of small platinum pans, twin rider displacement. The whole balance is heavily gilt.** Cross level and levelling screws. The balance is mounted in a highly polished mahogany and glass case, with balanced sliding door (front), on a black plate-glass base and bottom box with 2 drawers. Capacity 1 g, sensitivity $\frac{1}{600}$ mg, Figure 27. 0. 0
- 82 404. **Assay Balance**, with inverted tongue, beam of hard aluminium, insensitive to acid fumes and temperature changes. **Agate axes and bearings; with a pair of small detachable platinum pans, with double and sure rider displacement. The whole balance is heavily gilt,** without steel or iron parts, and is therefore immune from magnetic disturbances. In a polished mahogany and glass case with balanced front sliding door, on a black plate-glass base and bottom box, with cross level and levelling screws. Capacity 1 g, sensitivity $\frac{1}{100}$ mg, Figure 16. 10. 0
- 82 405. **Assay Balance**, simple pattern, with aluminium beam, all other metal parts heavily plated; **prismatic axes, plane central bearing of agate, with half-round detachable pans, heavily gilt.** In class case with balanced front sliding door on bottom box with drawer and levelling screws. Capacity 5 g, sensitivity $\frac{1}{10}$ mg, Figure 3. 4. 0



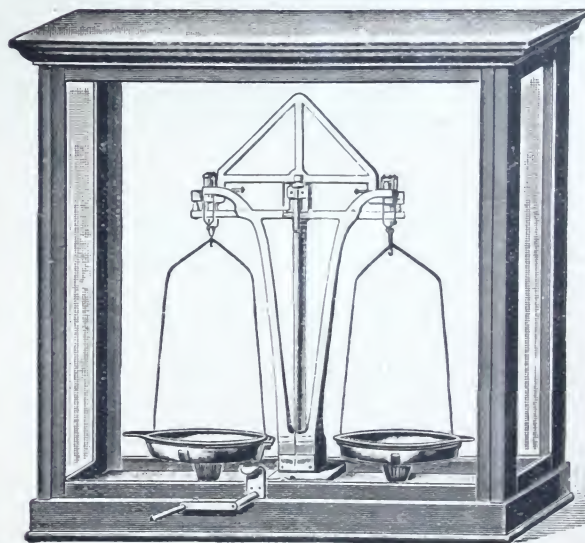
82 406 - 82 408. 1:8.



82 409 - 82 411. 1:12.



51 561b. 1:8.



51 560a. 1:8.

Chemico-Technical Balances.

Precision Balance, with pierced beam; agate bearings and knife-edges, arrestment for beam and suspension, flat middle bearing, adjustable carriers for the beam; plummet and levelling screws; suspension with double hook; detachable pans. On polished mahogany board with levelling screws, Figure.

— **idem**, in polished mahogany case with adjustable front sliding window, on base with drawer and levelling screws. **Without Rider Displacement.** Figure.

	List No. 82 406	82 407	82 408
To carry grams	100	250	500
Sensitivity mg	1	2	3
Length of beam cm	21	25	29
Pan diameter cm	8	10	12
Price, lacquered £	1.18.0	2.2.0	2.10.0

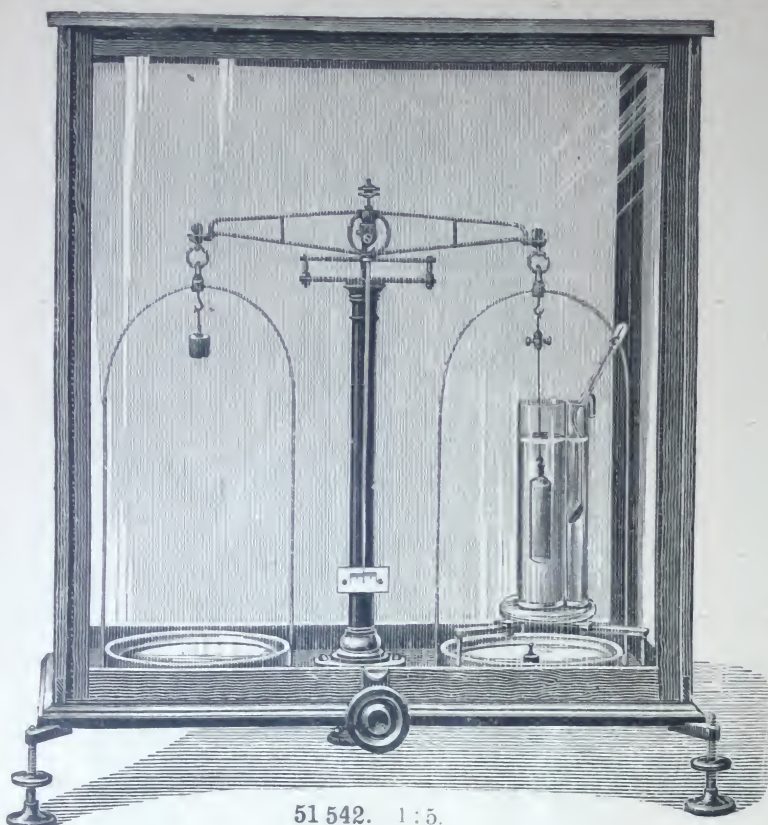
	List No. 82 409	82 410	82 411
To carry grams	100	250	500
Price, lacquered £	3.8.0	3.12.0	4.0.0

Chemico-Technical Precision Balance, with aluminium beam and brass stand (short beam), with arrestments for beam and suspension, brush pan stops, Figures 51 560a and 51 561b.

	List No. 51 558a	51 559a	51 560a	51 561a
To carry grams	5	50	200	1000
Sensitivity mg	1	2	4	10
a) In Glass Case £	2.15.0	3.5.0	4.5.0	5.10.0
b) On Box, with cornice £	2.5.0	2.15.0	3.10.0	4.10.0
c) On Board £	2.0.0	2.8.0	3.0.0	3.15.0

Precision Balance for heavier Loads, with short aluminium beam and enamelled iron stand; arrestments for beam and suspension, brush pan stops.

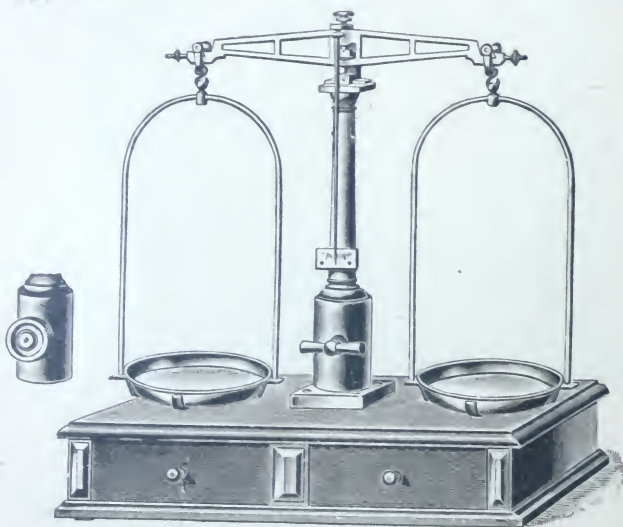
	List No. 51 562a	51 563a	51 564a	51 565a	51 566a
To carry kg	1	3	5	10	20
Sensitivity mg	10	20	30	50	100
a) In Glass Case £	5.0.0	6.0.0	7.10.0	9.10.0	12.0.0
b) On Box, with cornice £	3.15.0	4.10.0	5.15.0	7.10.0	10.0.0
c) On Board £	3.5.0	3.15.0	5.0.0	6.10.0	8.15.0



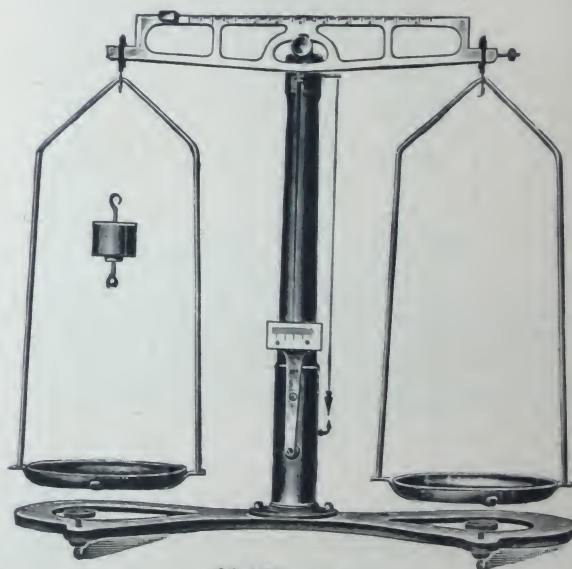
51 542. 1:5.



51 548a. 1:8.



82 412-82 422. 1:8.

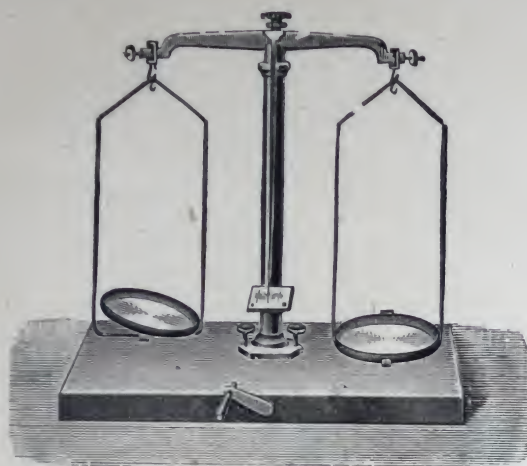


82 423. 1:6.

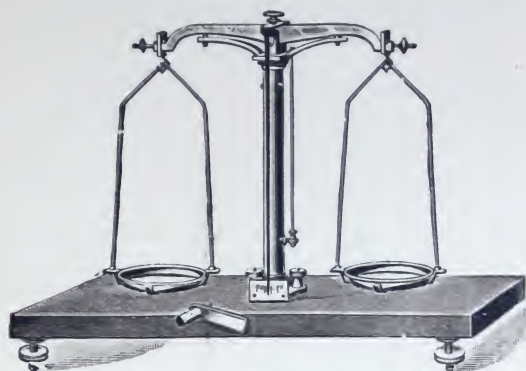
Precision Balance for Chemical and Physical Purposes, see Figure 51542, high sensitivity, also arranged as a **hydrostatic balance**, with beam and pan arrestments; glass case with balanced front sliding window. The price does not include the auxiliary parts illustrated, see Nr. 51545.

£ s. d.

		List No. 51540	51541	51542	51543	51544		
		To carry grams	100	200	500	1000	5000	
a)	On Board	£ 3. 10. 0	4. 0. 0	4. 5. 0	4. 15. 0	8. 5. 0		
b)	On base with levelling screws	£ 4. 0. 0	4. 10. 0	4. 15. 0	5. 5. 0	9. 0. 0		
51545. Auxiliary Parts to Balances No. 51540-51544: Tripod, Glass Jar, Plummets and Thermometer							1. 0. 0	
Chemico-Technical Balance , Figure 51548a, in polished, glazed walnut case with front sliding window (which may be fixed in any position) and with levelling screws.		List No. 51546a	51547a	51548a	51549a	51550a	51551a	
		To carry grams	20	50	100	200	500	1000
		Sensitivity mg	1	1	1	2	2	5
		Price	£ 2. 5. 0	2. 10. 0	2. 15. 0	3. 0. 0	3. 10. 0	4. 5. 0
Precision Balance with Excentric Arrestment for beam and pans, prismatic knife-edges, detachable pans; on polished mahogany case, with cornice and two drawers, Figure		List No. 82412	82413	82414	82415	82416	82417	82418
		To carry	50	100	200	500 g	1	3
		Price, lacquered	£ 2.5.0	2.10.0	2.15.0	3.0.0	3.10.0	4.0.0
		Extra Price for levelling screws	£ 0.2.0	0. 3.0	0.3.0	0.3.0	0.4.0	0.5.0
							0.6.0	0.7.0
							0.10.0	0.12.0
							0.15.0	



82 424 a—82 428 a. 1:8.



82 429 a—82 433 a. 1:10.

82 423. **Laboratory and Scholars' Practice Balance**, Figure on p. 1372, with black enamelled iron base and column to which is fitted a damping device so as to bring the balance to rest quickly. The beam is brass, nickel-plated, and is divided into 100 parts. On the beam is a rider enabling weighings up to 10 grams to be made without weights. **Axes and Bearings are of best hardened steel.** With prismatic axes and suspensions and hydrostatic pan, or counter-weight with two hooks. Carries 2 kg. Height of stirrup, 14"; pan diameter about 6"; length of beam, 13". This balance is sensitive to 20 mg £ s. d. 2. 0. 0

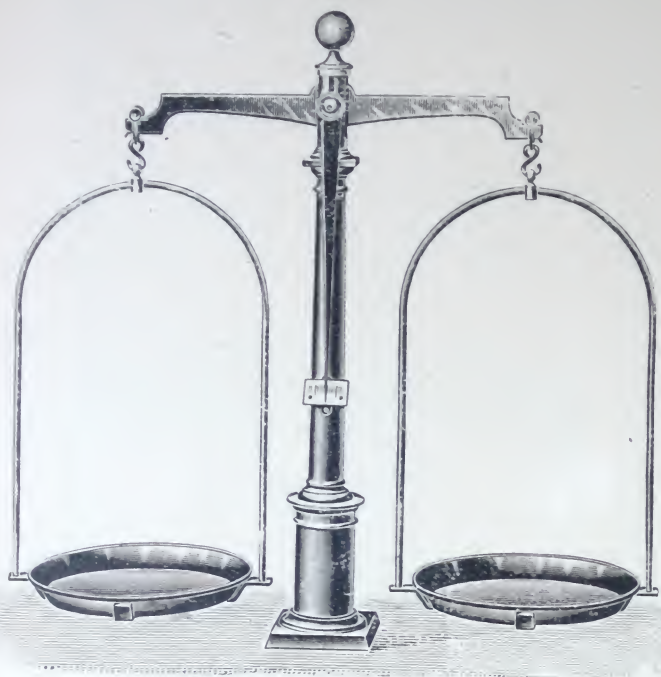
Chemical and Technical Precision Balance, Figure, with prismatic end knife-edges, double-hook stirrups; crosswise pans, with excentric arrestment, with **Steel Bearings** and **Steel Axes**.

List No.	82 424	82 425	82 426	82 427	82 428
To carry grams	50	100	250	500	1000
Sensitivity mg	3	5	7	9	10
Pan diameter cm	7	8	10	12	14
a) On polished mahogany board without levelling screws £	1.8.0	1.10.0	1.13.0	1.18.0	2.3.0
b) On polished mahogany box, with drawer, without levelling screws £	1.10.0	1.12.0	1.16.0	2.2.0	2.10.0
c) In polished mahogany box with adjustable front sliding window, on base box with moulding and drawer, without levelling screws £	2.12.0	2.18.0	3.5.0	3.14.0	4.5.0

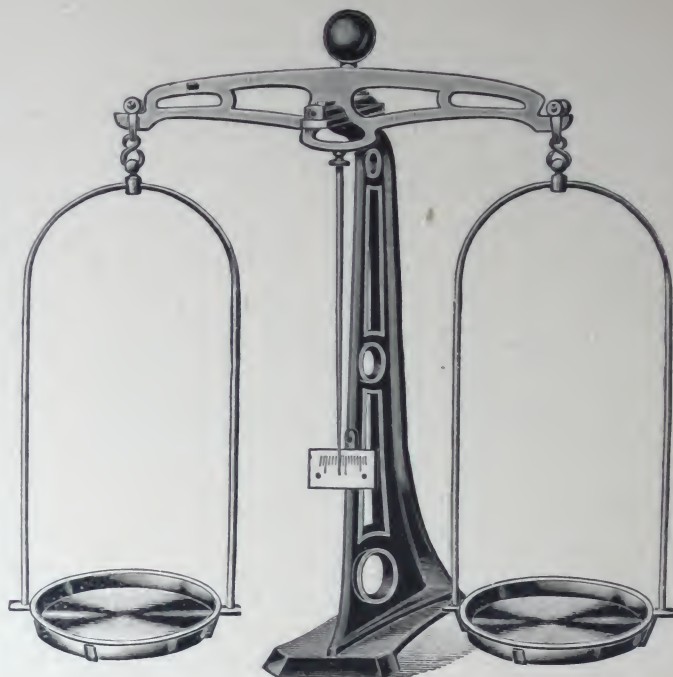
Chemical and Technical Precision Balance, Figure, with prismatic end knife-edges, double-hook suspension, detachable pans, with **adjustable supports for the beam**, with plummet. **Steel Axes** and **Steel Bearings**.

List No.	82 429	82 430	82 431	82 432	82 433
To carry grams	50	100	250	500	1000
Sensitivity mg	3	5	7	9	10
Pan diameter cm	7	8	10	12	14
a) On polished mahogany board with levelling screws £	1.11.0	1.13.0	1.16.0	2.3.0	2.8.0
b) On polished mahogany box, with drawer and levelling screws . . £	1.13.0	1.15.0	2.1.0	2.8.0	2.15.0
c) In polished mahogany box with adjustable front sliding window, on base box with moulding and drawer, with levelling screws £	2.16.0	3.2.0	3.9.0	3.19.0	4.10.0

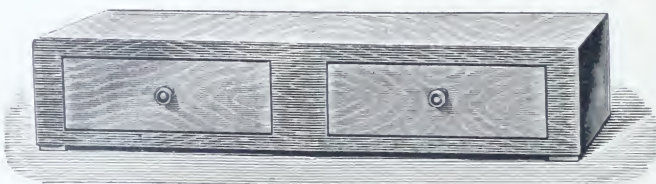
Prices of the balances No. 82 424—82 433 with **agate bearings** and **agate axes** on demand.



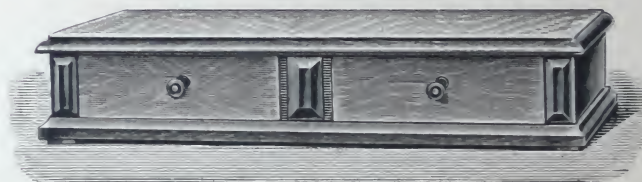
82 434 – 82 440. 1:8.



82 453 – 82 459. 1:8.



82 441 – 82 446. 1:10.



82 447 – 82 452. 1:10.

Taring and Precision Balances.

Taring Balance, with round brass column, solid beam, and detachable pans, brass-lacquered, Figure.

	List No. 82 434	82 435	82 436	82 437	82 438	82 439	82 440
To carry kg	0,5	1	3	5	10	15	20
Height of bearings cm	36	41	46	52	57	63	71
Pan diameter cm	14	16	19	22	26	29	32
Sensitivity mg	25	50	100	200	300	400	500
Price £	1.10.0	1.13.0	1.16.0	2.0.0	2.8.0	3.0.0	3.12.0

Polished Base Boxes, fumed mahogany, with two drawers, Figure.

	List No. 82 441	82 442	82 443	82 444	82 445	82 446
For balances to kg	1	3	5	10	15	20
Price £	0.12.0	0.15.0	0.18.0	1.5.0	1.10.0	1.15.0

— The preceding, with moulding, Figure.

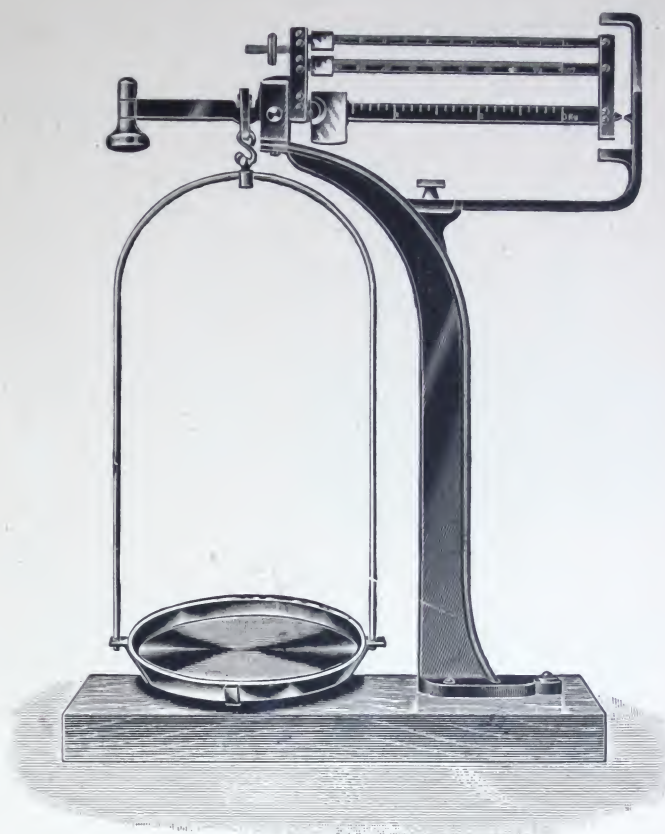
	List No. 82 447	82 448	82 449	82 450	82 451	82 452
Price £	0.15.0	0.18.0	1.4.0	1.10.0	1.15.0	2.0.0

Precision Balance on enamelled Cast Iron Stand, with pierced brass beam and detachable pans, brass-lacquered, Figure.

	List No. 82 453	82 454	82 455	82 456	82 457	82 458	82 459
To carry kg	0,5	1	3	5	10	15	20
Height of bearings cm	36	41	46	52	57	62	71
Pan diameter cm	14	16	19	22	26	29	32
Sensitivity mg	25	50	100	200	300	400	500
Price £	1.4.0	1.6.0	1.8.0	1.12.0	1.18.0	2.5.0	2.15.0



82 460-82 464. 1:6.



82 465-82 468. 1:6.

Precision Decimal Balances.

Precision Decimal Balances, on polished hardwood board with set of weights let into board, cast iron enameled column with brass beam and brass pans, and quadrant scale, Figure. £ s. d.

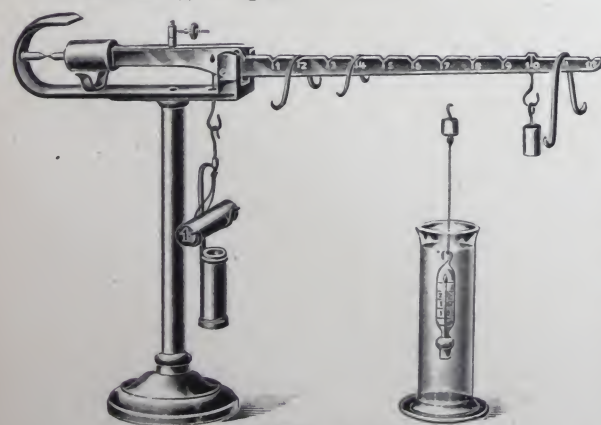
List No.	82 460	82 461	82 462	82 463	82 464
Carries kg	1	3	5	10	20
Size of scale between Stirrups, Ins.	6 1/4"	7 1/2"	9"	10 1/2"	13"
Sensitivity grams	0,1	0,3	0,6	1	2
Price £	1.6.0	1.12.0	1.18.0	2.8.0	3.6.0

Precision Rider Weight Decimal Balance, with 3 fixed (undetachable) rider weights and 3 scales for rapid and accurate weighing **without** weights, Figure. The sensitivity on the scale is 1/10 gram. The beam, stirrups and pans are of brass, and the stand iron, black enamelled, on nicely polished board.

List No.	82 465	82 466	82 467	82 468
Carries kg	3	5	10	20
Price, lacquered £	3.0.0	3.10.0	4.10.0	6.0.0

Special Balances. Specific Gravity Balances.

82 469. **Weight for determining the specific Gravity of Solids and Liquids** (as suggested by Drecker), Figure 4. 5. 0

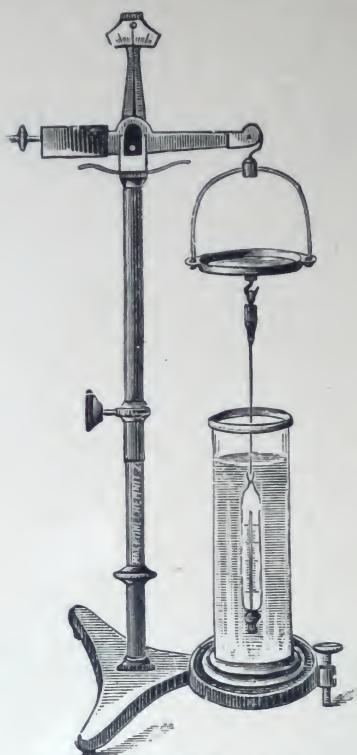


82 469. 1:5.

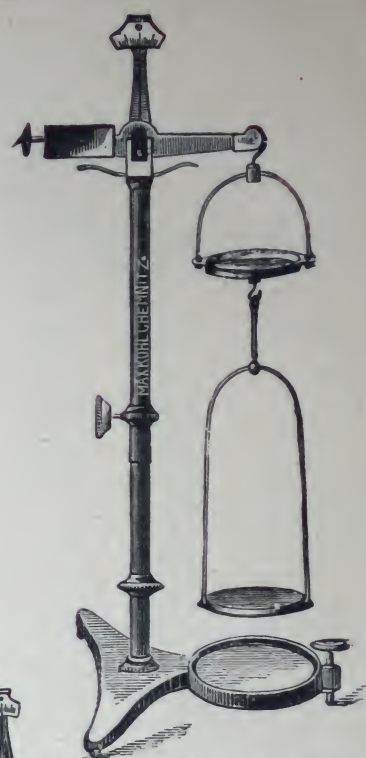
The shorter arm of the lever is fitted, at the same distance as the first scale-division of the longer arm, with a well thought out suspension device for supporting a hollow brass cylinder filled with water. A weight, suspended at the scale division 10 keeps the former in equilibrium. Into the hollow brass cylinder are fitted solid cylinders of lead, copper, brass, iron, zinc, beech, oak, fir, lime and elm wood and cork, in such manner that each of these exactly fills up the hollow. These small cylinders can be placed in the wire stirrup above the hollow cylinder. The weight of water filling the cylinder is taken as the unit, being represented by the large rider. When the cylinder is filled with water, this rider is suspended at 1 in order to establish equilibrium. As other riders of 1/10th and 1/100th are supplied, the specific gravities of the cylinders of metal or wood can be accurately determined to two places of decimals. Liquids can be poured into the hollow cylinder provided they are not likely to attack the brass. The apparatus includes a sinker, so as to enable it to be used as a **Mohr balance** as well.



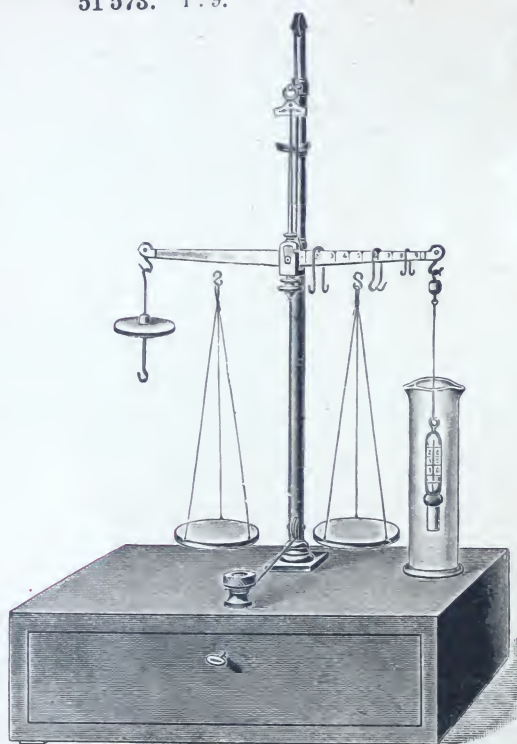
51 573. 1:9.



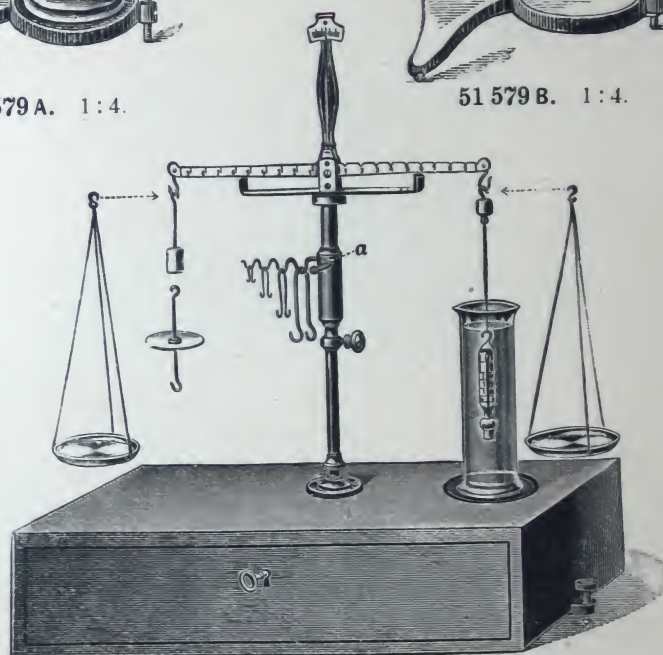
51 579 A. 1:4.



51 579 B. 1:4.

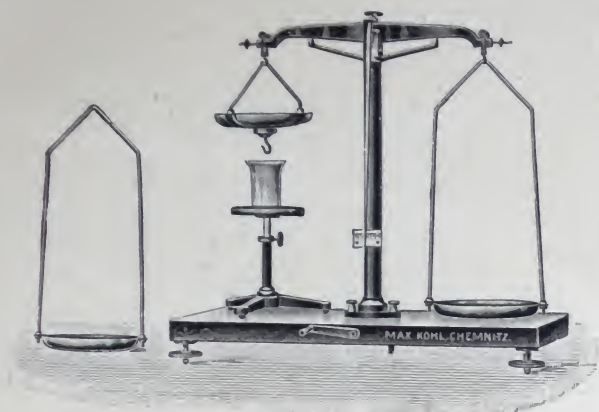


51 574. 1:6.



51 576. 1:6.

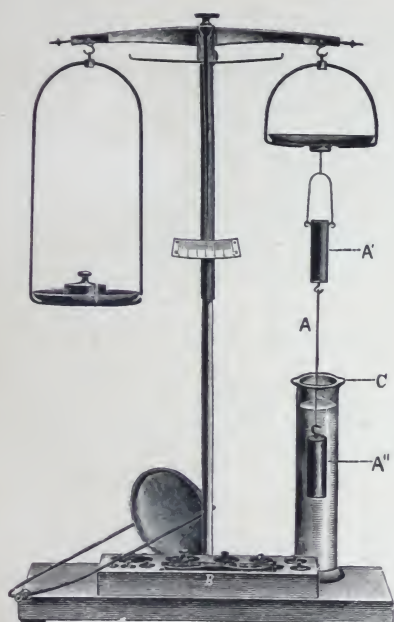
- 51 573. **Single Arm Balance** (Westphal's) for specific gravity determinations, Figure, with adjustable, lacquered brass stand £ s. d.
1. 6. 0
- With this balance the specific gravity of liquids can be determined to 4 places of decimals. The following pertain to the balance: 1 glass plummet, 1 Reimann flask with thermometer stopper, 1 counterpoise, 8 riders, 1 pair forceps and 2 platinum wires, case and instructions.
- 51 574. **Specific Gravity Balance** (Mohr's), Figure, with arrestable stand and pans for ordinary weighings, of lacquered brass with accessories illustrated, **Description** 1. 15. 0
- This balance serves for determining the specific gravity of liquids and solids to 4 decimal places. All parts can be placed in the lock-up drawer of the support.
- 51 575. — idem, with nickelled brass parts 1. 18. 0
- 51 576. **Specific Gravity Balance**, Figure, both arms graduated, with adjustable stand with support and with spring arrestment, the latter being actuated by lightly pressing the knob a. The central bearing and arrestment are of agate. The lock-up drawer is arranged to take the entire balance and the lower base has levelling screws.
Price, including accessories illustrated, balance lacquered 2. 0. 0
- 51 577. — idem, the balance nickelled 2. 3. 0
- 51 579. **Hydrometer** (Reimann's), Figs. A and B, for determining the specific gravity of liquids, with a 1-gram patent body and a pan for use as substitution balance, resting in polished box, with 2 glass jars 1. 10. 0
- 51 580. — idem, in glass case 2. 5. 0



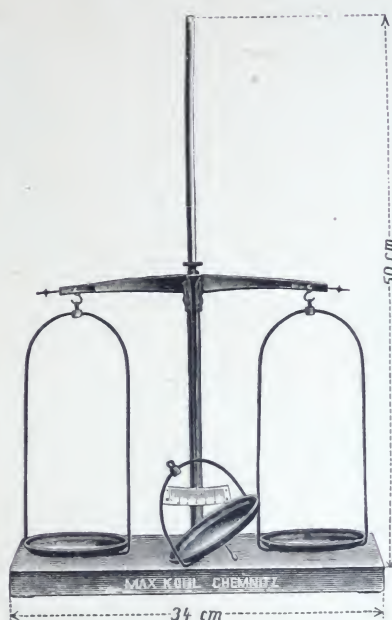
51 582. 1:12.



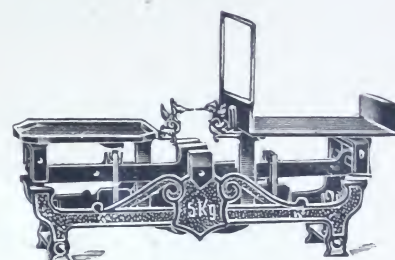
51 586. 1:10.



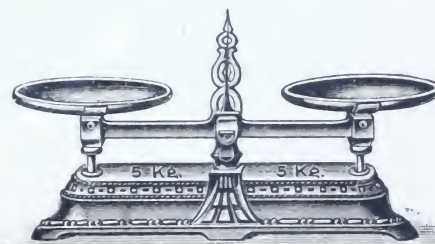
51 588. 1:8.



51 589. 1:8.



51 614. 1:10.



82 470-82 472. 1:9.

Hydrostatic Balances and Flat Balances.

Hydrostatic Balance, Figure 51582.

List No.	51581	51582	51583
To carry kg	1	2	5
Sensibility mg	10	20	50
Price £	3.10.0	4.0.0	5.0.0

Gunmetal Beam working on brass pillar, with beam arrestment, on mahogany board with two long and one short brass pans and adjustable plate stand. Axes working on stones.

Hydrostatic Balance, sufficient where demands are not great, Fig. 51586.

List No.	51584	51585	51586	51587
To carry grams	100	250	500	1000
Price £	0.13.6	0.14.6	0.17.0	1.0.0

51588. Hydrostatic Balance, to carry 250 grams, Figure, with beam adjustable in an up-and-down direction, 2 pans with long stirrup and 1 pan with short stirrup, brass body, jar and plummet (for explaining the Archimedian principle) and with set of weights from 1 mg to 200 grams. The balance indicates 5 mg 1. 10. 0

51589. — idem, without above-named accessories, Figure, with 3 pans 1. 0. 0

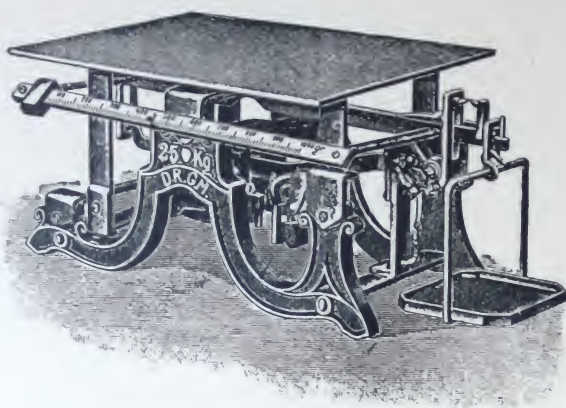
Flat Balance, Beranger system, Figure 51614 (M. T., p. 28).

List No.	51612	51613	51614	51615	51616	51617
To carry kg	1	3	5	10	15	20
Price £	0.16.0	0.18.0	1.0.0	1.5.0	1.12.0	2.0.0

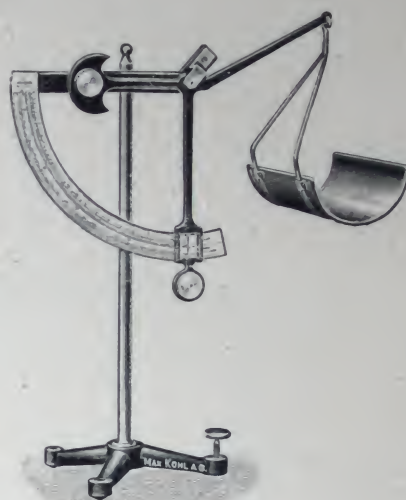
Flat Balance, Roberval system, with flat brass pan and cast-iron base, Figure.

List No.	82470	82471	82472
To carry kg	1	3	5
Price £	0.8.0	0.10.0	0.12.0

£ s. d.



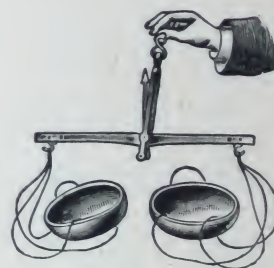
82 473-82 475. 1:12.



51 604. 1:10.



82 476-82 478. 1:6.



51 609. 1:8.

Table decimal Balance, with auxiliary rider weight, for weights up to 1 kg, and **weigh-pan** for decimal weighings, Figure. £ s. d.

List No.	82 473	82 474	82 475
Size of slab cm	40×28	50×36	60×44
To carry kg	25	50	100
Price £	1.18.0	2.5.0	3.0.0

Rider Weight Balance, without weights, very accurately constructed, mechanism in closed case, plated scales and rider weights, Figure; all other parts enamelled.

List No.	82 476	82 477	82 478
Size of slab cm	32×23	32×23	40×25
To carry kg	10	15	20
Price £	2.10.0	2.16.0	3.6.0

51 604. **Large Letter and Sorting Balance** (German "rapid" balance), Figure, accurately divided to 500 grams, compactly constructed for demonstrations and weighings in rapid succession

1. 16. 0

The manufacture of indicating balances is carried on as a special branch of our trade, and we supply these as per special price list, especially for the textile and paper trades.

51 605. **Bridge Balance** for 200 kg carrying capacity (M. T., p. 28), of oak

2. 0. 0

Hand Balance with round horn pans, Figure 51 609.

List No.	51 606	51 607	51 608	51 609	51 610	51 611
Length of beam cm	10	13	17	22	30	35
To carry grams	5	20	50	200	500	1000
Price £	0.2.6	0.3.3	0.4.0	0.5.0	0.8.6	0.12.0



51 623. 3 : 10.



51 631. 3 : 10.



51 645. 1 : 3.



82 479. 1 : 3.

Analytical Weights.

These weights, for accurate physical and chemical use, are adjusted so as to agree among each other, and with the standards of the Physikalisch-Technische Reichsanstalt (the German "National Physical Laboratory"), Charlottenburg.

List No.	51 621	51 622	51 623	51 624	51 625	51 626	51 627
From 1 mg to grams	10	20	50	100	200	500	1000
Comprising altogether grams	31	51	101	201	501	1001	2001
Price per Set £	0.18.0	1.0.0	1.3.0	1.8.0	1.17.0	2.7.0	2.19.0

The weights, with ivory forceps, are contained in a neat mahogany box; in the sizes down to 1 gram they have small knobs screwed in; they are made of brass, gilt and are each inserted in velvet. The fractional gram weights from 500 to 10 mg are placed under a thick glass cover.

The sets Nos. 51 621 to 51 627 can also be supplied at the same price **platinised** instead of gilt.

Analytical Weights, somewhat simpler construction, accurately calibrated, Figure 51 631.

List-No.	51 628	51 629	51 630	51 631	51 632	51 633	51 634
From 1 mg to grams	10	20	50	100	200	500	1000
Comprising together grams	31	51	101	201	501	1001	2001
Price per Set £	0.12.0	0.13.6	0.15.0	0.17.0	1.3.0	1.9.0	1.18.0

The weights, together with brass forceps are contained in a polished mahogany case; in sizes to 1 gram they are made of brass with heads screwed in and are gilt; the fractional grammes, of German silver, are under glass.

We also supply sets Nos. 51 628—51 634 at the same price **platinised** instead of gilt.

51 645. **Precision Fractional Gram Weights**, extra-fine calibration I, from 1 mg to 500 mg; 5, 2 and 1 mg of aluminium, the remainder of pure nickel, in mahogany case with lid and forceps, Figure

0. 5. 6.

82 479. — idem, in **simple mahogany sliding box**, Figure, with forceps

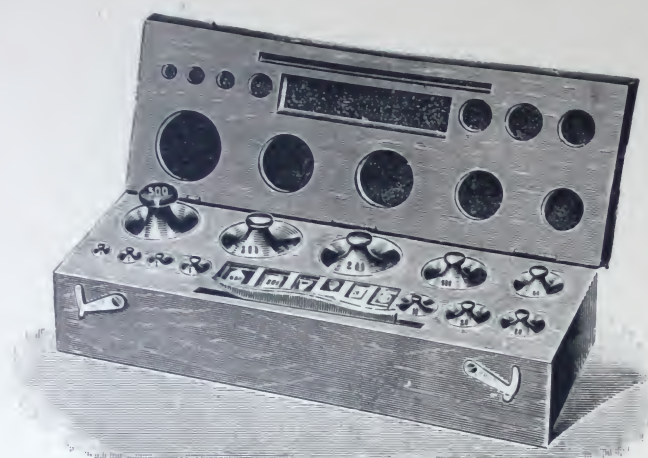
0. 4. 0.

Adjustment of the following Precision Weights.

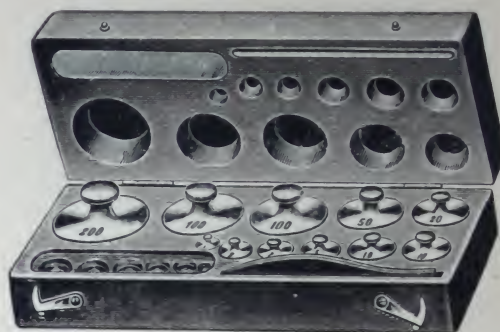
The precision weights about to be listed are adjusted in accordance with the limits of accuracy laid down by the German Weights and Measures Act as far as it applies to precision weights, and this accuracy is quite sufficient for the use of apothecaries.

For all **analytical balances** analytical weights are used, but these analytical weights are too expensive and too accurately adjusted for **technical balances**, which are more sensitively adjusted than chemists, (apothecaries') scales. On the other hand, medicinal weights are not accurate enough. For this purpose, and for use as standards at the local weights and measures offices, two calibrations, I. and II. are inserted.

The limits of error for these calibrations I and II, as well as the calibration corresponding to the medical weights, shown as calibration III, are given here.



51 643 a. 1:4.



51 649. 3:10.

The sets of weights with "Calibration I" have the accuracy required for Precision Check and Ordinary Standards; they can replace the analytical weights in a number of cases.

The sets with "Calibration II" have the accuracy required for Commercial Check Standards and Standards for ordinary use; they are employed for physical weighing operations.

The sets with "Calibration III" have the accuracy of the usual Precision and Medical Weights; they are used in physical experiments in which absolute accuracy is not essential, e. g., hydrostatic weighings.

Limits of Error within which weights are guaranteed accurate:

Weights:	1	2	5	10	20	50	100	125	200	250	500	g	1	2	5	10	20	50	kg
Calibration I	0,1	0,2	0,3	0,4	0,5	0,6	0,8	0,8	1,0	1,0	2,0		4	7	10	20	50	250	mg
Calibration II	0,6	0,8	1,0	1,4	1,7	2,0	3,0	3,0	4,0	4,0	5,0		10	30	50	80	150	500	mg
Calibration III	2,0	3,0	4,0	6,0	10	15	20	25	30	35	75		150	200	400	1000	1500	2000	mg

Fractional Gram Weights.

Weights:	1	2	5	10	20	50	100	200	500	mg
Calibration I	0,05	0,05	0,05	0,1	0,1	0,1	0,1	0,1	0,1	mg
Calibration II	0,1	0,1	0,1	0,2	0,2	0,2	0,4	0,4	0,4	mg
Calibration III	0,1	0,2	0,25	0,3	0,4	0,5	0,6	0,8	1,0	mg

The limit of error of the **Precision Check Standards** 1—50 milligramm is less than given under Calibration I, amounting to

Weights:	1	2	5	10	20	50	mg
	0,01	0,02	0,025	0,05	0,05	0,05	mg

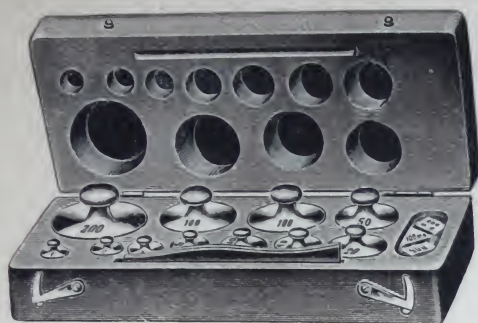
Precision Gram Weights.

Precision Weights, extra-fine calibration I, in polished pear-wood box with forceps, the grams being of phosphor bronze, the fractions of German silver, under glass, all the "twos" being in duplicate, Figure 51 643 a.

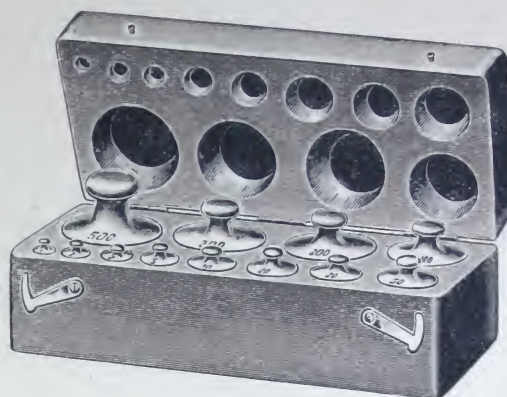
List No.	51 639	51 640	51 641	51 642	51 643 a	51 644 a
1 mg to g	20	50	100	200	500	1000
Price per Set £	0.7.0	0.8.6	0.10.0	0.15.6	1.2.0	1.10.0

Precision Weights, with fine calibration II, Figure 51 649, in polished beech box, with forceps, of nickelled brass, the fractions of German silver, under glass; containing 100, 10, 2, 0.1, 0.01 g in duplicate; the 100 gram set has only one 100 gram weight.

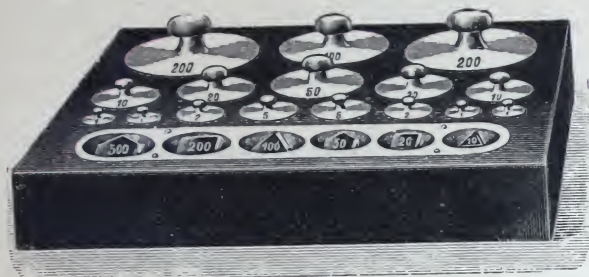
List No.	51 646	51 647	51 648	51 649	51 650	51 651
10 mg to g	20	50	100	200	500	1000
Price per Set £	0.4.6	0.5.0	0.6.0	0.9.0	0.12.0	0.17.0



51 655. 3:10.



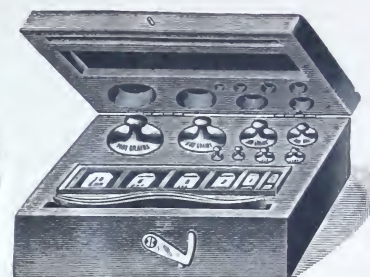
51 662. 3:10.



82 480. 1:3.



51 666. 1:4.



82 482. 1:4.

Precision Weights, with fine calibration II, in polished beech block case, with forceps, of brass, nickelled, the fractional grams of German silver, without glass. The 100, 10, 2, 0.1 grams are in duplicate. Figure 51 655.

List No	51 652	51 653	51 654	51 655	51 656	51 657
100 mg to g	20	50	100	200	500	1000
Price per Set £	0.3.6	0.4.6	0.5.6	0.8.0	0.11.6	0.16.6

Precision Weights, with calibration III, in polished beech block box, of nickelled brass, the 100, 10 and 2 grams being in duplicate. Figure 51 662.

List No.	51 658	51 659	51 660	51 661	51 662	51 663
1 g to g	20	50	100	200	500	1000
Price per Set £	0.2.6	0.3.0	0.4.0	0.6.0	0.8.6	0.13.0

82 480. **Precision Weights**, with calibration III, in pear-wood block, 10 mg—200 g, nickel-plated brass: 10; 20; 20; 50; 100; 200; 500 mg. 1; 1; 1; 1; 2; 2; 5; 5; 10; 10; 20; 20; 50; 100; 200; 200 g. For the fractional grams, a brass **inset**, is fitted in which the fractional grams rest in **round cavities**, and from which they can easily be removed with the fingers without the necessity of using the tweezers, Figure 82 480.

This set of weights is specially intended for the 1 kilogram taring balance, the size enabling the weights to be placed in the drawers of the 1 kg box.

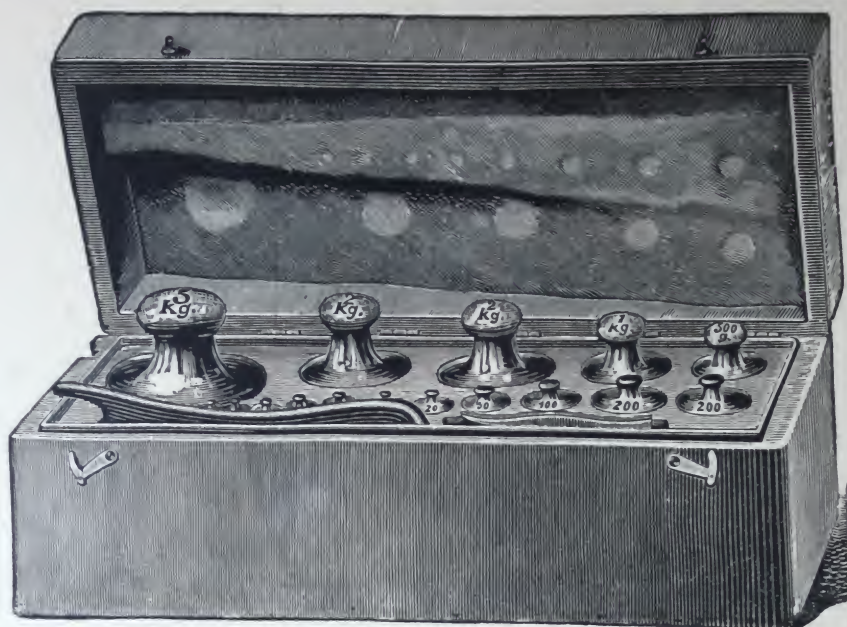
Precision Weights, with calibration III, in sliding box with forceps, nickelled, the "twos" being in duplicate, Figure 51 666.

List No.	51 664	51 665	51 666	51 667
1 mg to g	1	2	5	10
Price per Set £	0.2.0	0.2.3	0.2.6	0.2.9

English Precision Weights.

Set of English Troy Weights, in polished beechwood block-box, with forceps. These weights are of nickel-plated brass, and, from 10 grains to 0.1 grain, of German silver, and under glass, Figure 82 481.

List No.	82 481	82 482
0.1 grain to grains	600	1000
Price per Set £	0.7.0	0.8.6



51 670, 51 674. 1:4.



82 483—82 485.

82 486—82 494.

Precision Weights, with calibration III, in polished walnut case, upholstered plush, with fork and forceps, nickelled, the "twos" being in duplicate, Figure 51 670. £ s. d.

List No.	51 669	51 670	51 671
1 gram to kg	2	5	10
Price per Set £	1.17.0	2.17.0	4.12.0

Precision Weights, same construction as Nos. 51 669—51 671, but of Phosphor Bronze, with extra-fine calibration I, Figure 51 674.

List No.	51 673	51 674	51 675
1 g to kg	2	5	10
Price per Set £	3.3.0	4.13.0	7.10.0

Calibrated Iron Weights.

List No.	51 676	51 677	51 678	51 679	51 680	51 681	51 682	51 683	51 684
	100	200	500 g	1	2	5	10	20	50 kg
Each £	0.0.7	0.0.8	0.0.9	0.11.0	0.1.4	0.2.8	0.4.5	0.9.0	1.0.0

Precision Fractional Gram Weights.

Fractional Grams, German Type (in accordance with Regulation of the Standards Committee of the German Empire, 24th December, 1884), 500—50 mg of German silver; 20, 10, 5, 2, 1 mg of aluminium, with raised numbers, Figure.

82 483. 100 of each sort, uncalibrated	0.3.0
82 484. 100 assorted, uncalibrated	0.3.6
82 485. 1 Weight, uncalibrated	0.0.1

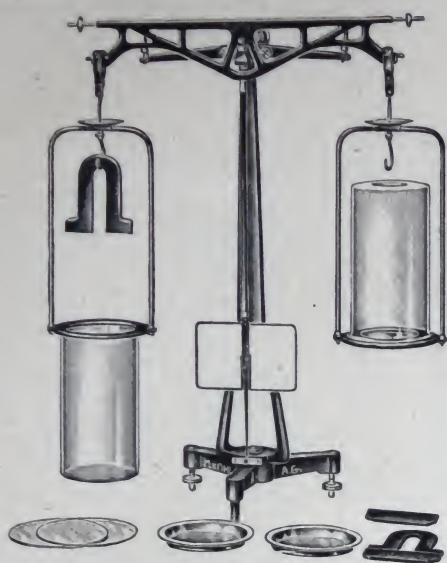
Single Precision Gram Weights, Calibrated to Precision Accuracy.

Uncalibrated Brass Weights, nickel-plated, Figure.

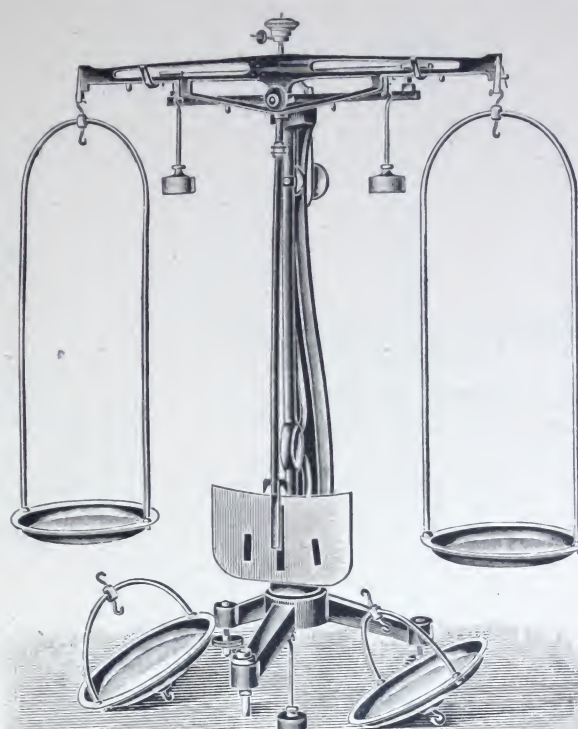
List No.	82 486	82 487	82 488	82 489	82 490	82 491	82 492	82 493	82 494	82 495	82 496	82 497	82 498
	1	2	5	10	20	50	100	200	500 g	1	2	5	10 kg
Each, £	0.0.1	0.0.1	0.0.2	0.0.3	0.0.4	0.0.5	0.0.8	0.1.2	0.2.7	0.4.4	0.9.6	1.0.0	1.17.0

— idem, of Phosphor Bronze.

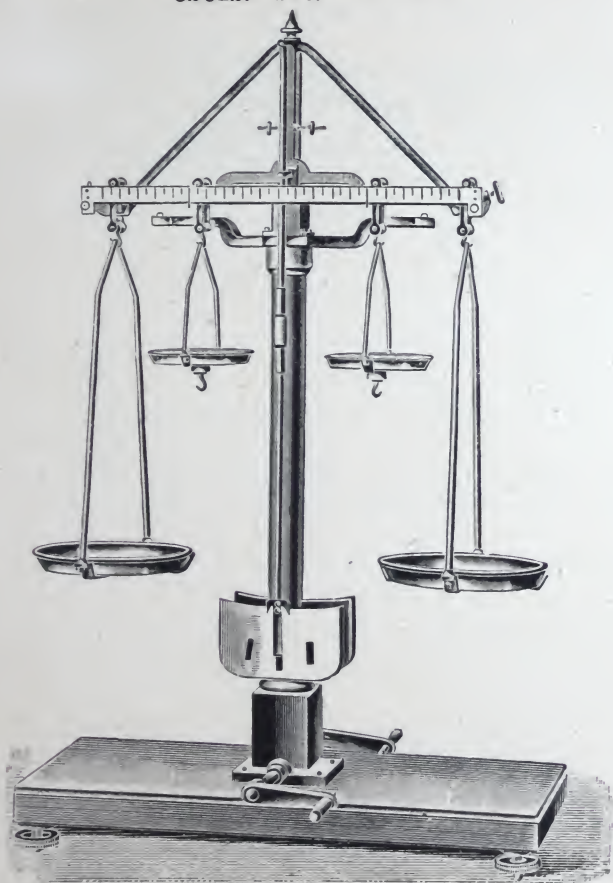
List No.	82 499	82 500	82 501	82 502	82 503	82 504	82 505	82 506	82 507	82 508	82 509	82 510	82 511
Each £	0.0.1	0.0.2	0.0.2	0.0.4	0.0.4	0.0.7	0.0.11	0.1.8	0.3.6	0.6.7	0.15.0	1.10.0	3.0.0



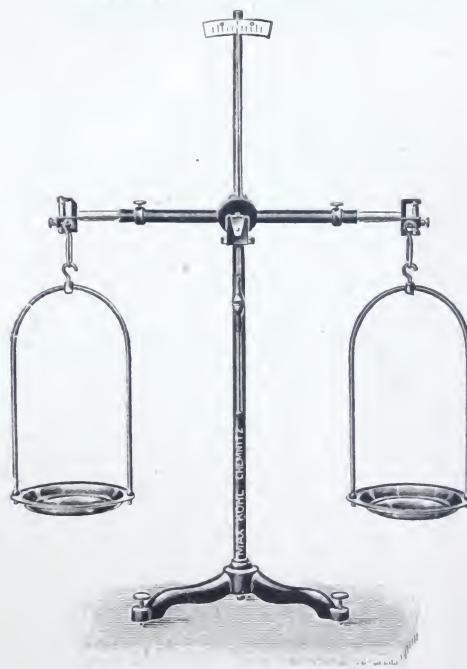
82512. 1:6.



51590. 1:5.



51593. 1:11.



51594. 1:8.

82512. **Demonstration Balance for Chemical and Physical Lecture Work, Figure.** This balance carries 1—2 kg, is sensitive to 10 mg, and has beam arrestment, steel axes on agate bearings, each with 1 pair of accurately tared experimental glass cylinders containing about 2 litres, tared, plane-ground-glass discs for closing the cylinders, and hardened horseshoe magnet with wide poles. The scale can be read at a fair distance away to 0.01 with 1 kg load in each pan

This balance is used, inter alia, for demonstrating increase in weight due to oxidation, the weight conditions of gases, the atmospheric air, and for specific gravity determinations, etc.

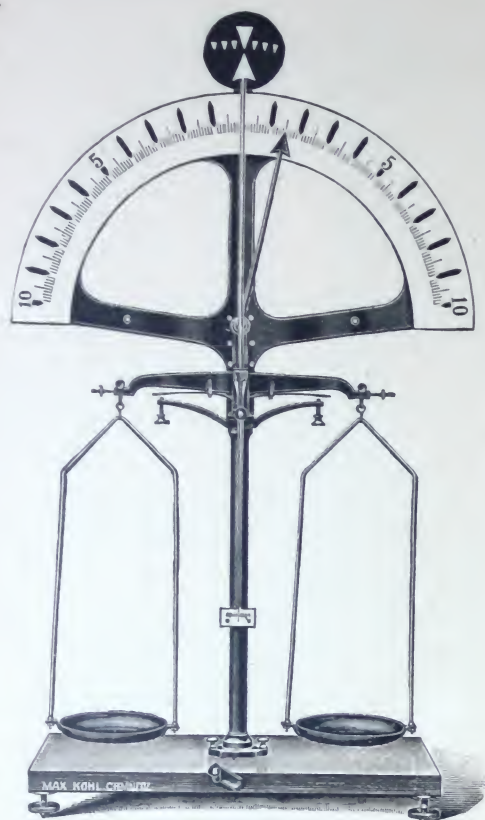
51590. **Demonstration and Hydrostatic Balance, Figure, with 2 weights of 200 g and 1 weight of 100 g, also 2 long and 2 short pans, Description**

The balance is 60 cm high, fitted with rigid pillar and is very sensitive for its size. The deflections are large and can be read from a distance.

The balance permits of explaining: distribution of the lever — shifting of centre of gravity — increase and decrease of sensitivity on lengthening and shortening the lever — results of placing the suspension axes above or below the central axis — testing the balance for proportionality — adjusting the inequality of arms — correct weighing with an unequal arm balance — determining the error of the lever — use of balance for determining the specific gravity of solids and liquids.

The balance can in addition be used as a tare balance for loads to 1 kg.

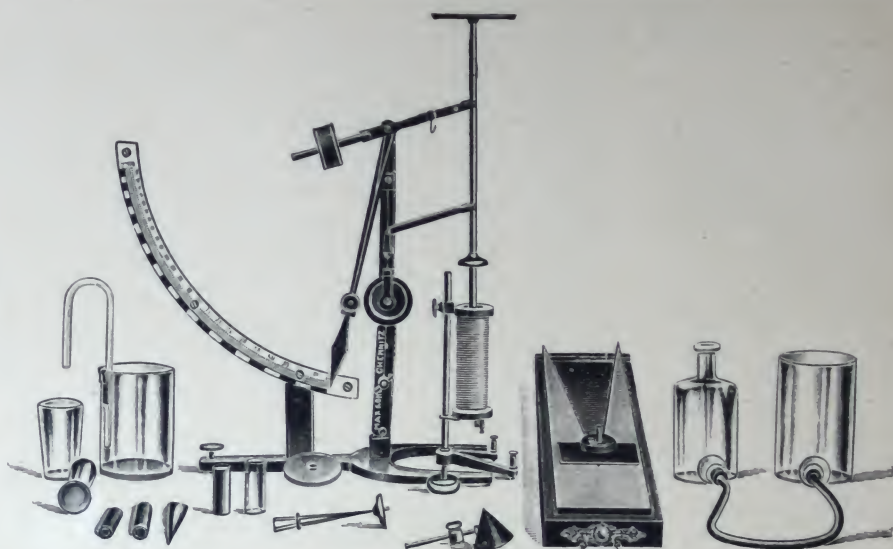
Cl. 6729, 7294,
7295, 3791.



51 595. 1 : 10.

The following instructive experiments, amongst others, may be carried out with the balance:

- Equal and unequal arm balance with long pointer;
- Weighing with the rider scale;
- Equal arm balance with short pointer;



51 597—51 600. 1 : 10.

51593. Large Demonstration and Hydrostatic Balance, Figure, on page 1383, Description

The balance is 1,10 m high and has a sensitivity of 10 mg on each side with its maximum load of 5 kg, thus rendering it suitable for use as an ordinary balance.

The balance has excentric arrestment, rider scale and two pans of different sizes; as the suspenders are exactly equal the smaller pans can be suspended instead of the larger.

The beam has two pointers and the pillar two scales, one of each of these facing the lecturer and the other the audience.

The following experiments, amongst others, may be carried out with the balance:

- Lengthening a lever arm;
- Shifting the line of axis above or below;
- Hydrostatic Balance.

£ s. d.
12. 0. 0

51594. New Demonstration Balance, Buff's, Figure on page 1383 (W. & E. phys. Prakt., Fig. 29), Description

1. The knife edges carrying the pans can be brought into the same plane as the central knife edge or be removed from the latter. 2. The centre of gravity of the beam can be displaced, and 3. the length of the arms of the beam can be varied.

2. 15. 0

51595. Chemical and Hydrostatic Demonstration Balance (Schwedoff's), Figure (Ztschr. f. d. phys. u. chem. U. 16, 1903, p. 321. — Frick, Phys. Techn. II, 1, Eig. 2128)

6. 10. 0

In order to obviate the tedious selection of suitable small weights and the inconvenience of laying the rider on the beam during the lecture, and to facilitate reading from a distance, a spring pointer is firmly fixed to the beam of the balance, this pointer being arranged in front of a semi-circular scale. In using the balance the weight to be determined is first obtained roughly by adding tare weights to the pan; the fine pointer is then guided by hand over the scale, this motion causing a small knob, fixed in front, to move in the corresponding direction until the beam has reached the state of equilibrium. In this position the fine pointer shows the fractions. With the aid of the arresting fork it is possible to support both arms of the beam at once or each separately.

51596. Weighing Pan for hydrostatic experiments, for preceding balance

0. 5. 0

51597. Demonstration Indicating Balance (Hartl's), Figure, suitable for a large number of experiments in statics, mechanics and electro-mechanics (Ztschr. f. d. phys. u. chem. U. 10, p. 127), for 250 and 500 grams range, without accessories

3. 15. 0

The balance is used for measurement experiments as to adhesion and cohesion of liquids, friction, stability, magnetic attraction, etc.; also for demonstrating Archimedes' principle and for determining the density of solids and liquids.

51598. Simple Accessories for Balance No. 51597: 1 adhesion plate (glass), 1 tribometer with slider, 1 glass jar and 1 glass flask, connected together by rubber tubing; 1 plunger, 1 holder with wire clamp, 1 massive iron cylinder, see Figure, Description

1. 5. 0

51599. Further Accessories for Balance No. 51597: 1 floater, 1 glass jar with syphon, 1 beaker, 1 hollow cylinder, 1 solid cylinder, 1 sheet metal plate, 1 wood block (cf. Ztschr. f. d. phys. u. chem. U. 8, p. 207); in addition, for experiments on the dependence of wind pressure on the shape of the impressed surface and the dependence of the resistance of a liquid against the motion of a solid in the same on the velocity and the shape of the impact surface of the body: 1 hollow brass cone, 1 hollow brass sphere, 1 base support. There is also comprised in the accessories 1 measuring flask (pycnometer) for determining the density of pulverulent bodies, see Figure, Description

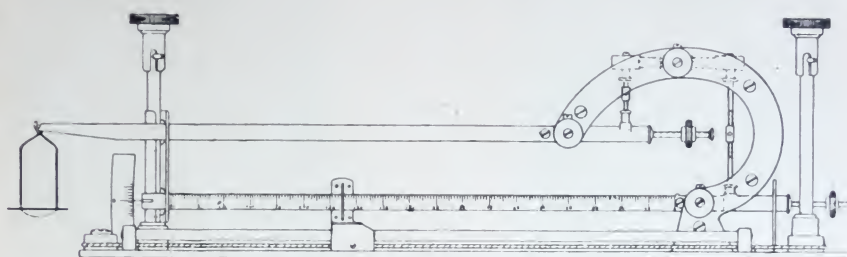
3. 0. 0

51600. Solenoid on Stand, with soft iron core and hollow iron cylinder, for experiments on magnetic attraction. Accessory for balance No. 51597, see Figure, Description

0. 15. 0



82 515. 1:5.



82 524. 1:3.

Torsion Balances.

The **Torsion Balances**, Figure, used for the **rapid determination of small and the smallest weights**, are used particularly for **frequent weighings** which follow at quick intervals, i. e., in **spinning mills, weaving mills, textile test laboratories, paper mills, chemical works, drug manufacturers factories**, and sometimes for **blood tests**. The rapidity of the weighing operations, which are **extremely accurate**, is achieved by **immediate and practically dead-beat operation of the beam**, combined with the pointer which enables the **desired weight to be read off rapidly on a scale**. **Description.**

The balances can also be supplied with two ranges of measurement, the principal scale, due to the suppression of the zero point, commencing at half its maximum, while a secondary scale contains the values from zero to half the maximum. In this case a comparison weight, corresponding to half the maximum of the principal scale, is supplied with the balance. The weighings from zero upwards are then carried out by suspending on the balance the comparison weight and the material or substance to be weighed.

For **weighing granular or pulverulent substances, small pots or pans** of German silver or aluminium are supplied to order; and for **weighing of fibre, yarn or similar material, wires, etc.**, a small compensating hook of the same weight as the pan or pot.

The metal base, column and housing of the balance are enamelled black, and parts subjected to wear are nickelplated. A pair of tweezers with ivory jaw is also supplied in a pasteboard box.

List No.	Range Milligrams	Value of a Scale-Division mg	Price £	List No.	With Initial Values suppressed Chief Range, mg	Secondary scale mg	Value of a Scale-Division of the Principal Range mg	Price £
82 513	0—30	0,1	7.10.0	82 517	30—60	0—30	0,1	8. 5.0
82 514	0—100	0,2	7.10.0	82 518	50—100	0—50	0,1	8. 5.0
82 515	0—500	1	7.10.0	82 519	250—500	0—250	0,5	8.10.0
82 516	0—1000	2	7.10.0	82 520	500—1000	0—500	1	8.10.0

82 521. Flat German Silver Container , 9 mm Diameter	£ s. d. 0. 3.0
82 521a. Hemispherical German Silver Pot , 8 mm Diameter	0. 3.0
82 522. Larger radiused Aluminium Pan , 19 mm Diameter	0. 3.0
82 523. Compensating Hook	0. 3.0

82 524. **Micro-Balance** as suggested by Prof. Kisch, Figure, **for quickly making a series of weighings**, range 9—300 mg, sensitive to 0,5 mg. This balance is portable, is lightly constructed but very steady. It has folding metal feet 8.10.0

The balance is very suitable for making weighings in chemical laboratories, drug factories, and for apothecaries and paper and textile testing laboratories.



82 525. 1:9.



82 526 - 82 531. 1:9.



82 533 - 82 538. 1:9.

School Clocks.

82 525. **School Master Clock**, with **strong spring action**, 8-day, for working as many as 30 secondary clocks, Figure. The clock is fitted in a lock-up oak case, and has a silvered dial about 10" diameter with excentric seconds pointer, and $\frac{3}{4}$ second pendulum. **Without signalling device**. Working tension for secondary clocks and signals 8, 12 or 24 volts. Size approximately 38"×14"×6 $\frac{1}{2}$ "

£ s. d.

5. 17. 0

— idem, with **Signalling Device**, Figure.

With 24-Hour Signalling Wheel			With 12-Hour Signalling Wheel and automatic Night Switch	
5 Minute Adjustment			2 $\frac{1}{2}$ Minute Adjustment	
	List No.	Price £	List No.	Price £
For 1 Circuit	82 526	8.6.0	82 529	9. 5.0
For 2 Circuits	82 527	9.1.0	82 530	10. 3.0
For 3 Circuits	82 528	9.8.0	82 531	10.12.0

82 532. **School Master Clock**, with **automatic electric winding** and **weight-driven**, for working as many as 30 secondary clocks. The clock is fitted in a lock-up oak case, and has a silvered dial about 10" diameter with excentric seconds pointer, and $\frac{3}{4}$ -second pendulum. Weight can also be raised by hand. Runs for 30 Hours. Size approximately 38"×14"×6 $\frac{1}{2}$ ". Working tension for winding, secondary clocks and signals 8, 12 or 24 volts direct current. **Without signalling device**

8. 2. 0

— idem, with **signalling device**, Figure. Size approximately 38"×14"×6 $\frac{1}{2}$ ".

With 24-Hour Signalling Wheel			With 12-Hour Signalling Wheel and automatic Night Switch	
5 Minute Adjustment			2 $\frac{1}{2}$ Minute Adjustment	
	List No.	Price £	List No.	Price £
For 1 Circuit	82 533	10.11.0	82 536	11.11.0
For 2 Circuits	82 534	11. 6.0	82 537	12. 8.0
For 3 Circuits	82 535	11.12.0	82 538	12.17.0

Extra Price for Signalling Devices see p. 1388.



82 540—82 545. 1 9.



82 546—82 551. 1:9.



82 552—82 557. 1:9.

82 539. **School Master Clock** with automatic electric winding and weight-driven for working as many as 30 secondary clocks. The clock is fitted in a lock-up oak case, and has a silvered dial about 10" diameter with excentric seconds pointer, and a second pendulum. Weight can also be raised by hand. Runs for 30 Hours. Size approximately 133×36×17 cm. Working tension for winding, secondary clocks and signals 8, 12 or 24 volts direct currents. **Without signalling device**
— **idem**, size approximately 133×36×17 cm, **with signalling device**, Figure.

£ s. d.

9. 14. 0

With 24-Hour Signalling Wheel			With 12-Hour Signalling Wheel and automatical Night Switch		
	5 Minute Adjustment			2½ Minute Adjustment	
	List No.	Price £	List No.		Price £
For 1 Circuit . . .	82 540	12. 2. 0	82 543		13. 2. 0
For 2 Circuits . . .	82 541	12. 17. 0	82 544		13. 18. 0
For 3 Circuits . . .	82 542	13. 4. 0	82 545		14. 8. 0

Signalling Clock, exclusively for working signalling installations, with strong spring action, 8-day, Figure. The clock is fitted in a lock-up oak case, and has a silvered dial about 10" diameter and ¾-second pendulum. The time of signal can be varied from 10—25 seconds, and the signalling wheel is not under current. Size approximately 38"×14"×6½".

With 24-Hour Signalling Wheel			With 12-Hour Signalling Wheel and automatical Night Switch		
	5 Minute Adjustment			2½ Minute Adjustment	
	List No.	Price £	List No.		Price £
For 1 Circuit . . .	82 546	4. 4. 0	82 549		5. 5. 0
For 2 Circuits . . .	82 547	5. 0. 0	82 550		6. 2. 0
For 3 Circuits . . .	82 548	5. 8. 0	82 551		7. 0. 0

— **idem**, with automatic electric winding and weight-driven, Figure, runs for 30 Hours, suitable for direct and alternating current. Working tension for direct current 8 volts, for alternating current 20 volts.

With 24-Hour Signalling Wheel			With 12-Hour Signalling Wheel and automatical Night Switch		
	5 Minute Adjustment			2½ Minute Adjustment	
	List No.	Price £	List No.		Price £
For 1 Circuit . . .	82 552	5. 10. 0	82 555		6. 10. 0
For 2 Circuits . . .	82 553	6. 5. 0	82 556		7. 8. 0
For 3 Circuits . . .	82 554	6. 14. 0	82 557		8. 5. 0



82 562—82 565. 1:6.



82 566—82 569. 1:5.



82 570—82 574. 1:6.

Extra Price for Signalling Devices on Master Clocks and Signalling Clocks.

	£	s.	d.
82 558. Automatic device for cutting off signals on Sundays or any desired week-days	2.	0.	0
82 559. Automatic Reversing or Change-over Switch from two circuits on Saturday and Monday, with cut-out for Sundays	2.	5.	0
82 560. For fitting in a press button	0.	2.	0
82 561. For fitting in a cut-out	0.	2.	0

Secondary Clocks in Metal Cases.

All secondary clocks have polarised electromagnetic systems and are arranged to run off primary batteries or accumulators. Where it is desired to run them off 110—120 volt supplies, the mechanism of the clocks must have a considerably higher resistance and series resistances fitted. For these a suitable extra charge is made. **Alternating or Threephase current is not suitable for directly driving secondary clocks**, except through a rectifier which is used to charge up accumulators.

Secondary Clocks with 1 Dial, with sectioned zinc frames, protecting glass and bezel, Figure. Where the clocks are used in the better type of room the zinc frames can be burnished copper colour, or enamelled white or in colours.

List No.	Diameter of White Dial	Price £	List No.	Diameter of White Dial	Price £
82 562	20 cm	1. 11. 0	82 564	30 cm	1. 15. 0
82 563	25 cm	1. 13. 0	82 565	40 cm	2. 10. 0

Secondary Clocks, with 1 Dial, with narrow Frames of Brass or Nickelplated Brass, for letting into walls, switchboards etc. Figure.

List No.	Diameter of Dial	Price £	List No.	Diameter of Dial	Price £
82 566	20 cm	1. 8. 0	82 568	30 cm	1. 13. 0
82 567	25 cm	1. 11. 0	82 569	40 cm	2. 7. 0

Twin Secondary Clocks in Metal Cases with narrow ornamental and burnished zinc frames, protecting glasses and chain suspension, for corridors, larger rooms, lecture-rooms etc., Figure.

List No.	Diameter of Dial	With Non-transparent Dials	List No.	With transparent Dials
82 570	30 cm	4. 5. 0	—	—
82 571	40 cm	5. 4. 0	82 573	6. 12. 0
82 572	50 cm	6. 15. 0	82 574	8. 5. 0

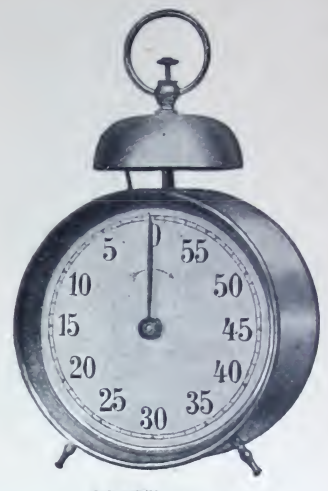
Max Kohl, Aktiengesellschaft, Chemnitz, Germany.



82575. 1:3.



82576. 1:3.



82577. 1:3.



51692 - 51694. 1:5.

82575. **Precision Chronometer, Figure, running up to 5 minutes, for observing time-intervals of 10 seconds to 5 minutes, with long or short alarm signal by bell from about 2 seconds before the desired period has elapsed** £ s. d. 0. 16. 0

The pointer is set to the desired figure by turning it with the special key supplied, and the same operation also winds up the chronometer, so that it is **not necessary to wind the latter separately**. The alarm mechanism is operated, **after** setting the clock, by pressing the button in the middle of the bell, the time the bell sounds depending on the time the finger is kept on the button. While the bell button is being pressed, the pointer should not exceed the numbers 5 or 0 in either direction. For **time observations of under 1 minute** the pointer is first set by turning it to the right beyond the one minute mark and then setting it back to the desired time. **Before** the pointer is set, the side lever is pressed **down** to the position marked „Ruhe“ (rest), being **afterwards** moved up to the position marked „Gang“ (going) when the pointer has been set and the alarm mechanism wound up.

82576. — **idem, Figure, running to 60 minutes, for observing time intervals of from 1 to 60 minutes, with short or long alarm signal for any given point of time set by the pointer** 0. 16. 0

The desired time is set and the alarm mechanism wound up in the same way as in No. 82575. For **time observations of below 5 minutes** the pointer is first set at 5 minutes to the right (say, at „10“), and then wound back to the particular minute desired.

82577. **Precision Chronometer with bell-signal, alarm-clock pattern, Figure, running for 36 hours, for observing intervals of time of from 1-60 minutes or beyond** 0. 10. 0

The ordinary clock and the alarm mechanism are wound up, as in the ordinary type of alarm clock, by turning the two keys in the direction of the arrows. For setting the chronometer for time-intervals of from 1 to 60 minutes, the pointer is set by turning a knob at the back in the direction of the arrow, pressure being applied at the same time to the knob (button) on top of the clip. As soon as the pointer passes „0“ the bell rings, and can be switched off by lightly pressing on the clip button. For setting the chronometer for time-intervals of over one hour, the number of minutes exceeding the full hour are set as above.

51692. **Clock with 10-second Signal, for Laboratories, Figure, the clock gives a soft signal every 10 seconds** 1. 2. 0

51693. — **idem, with Half-minute Signal, Figure** 1. 0. 0

51694. — **idem, with Minute Signal, Figure** 0. 17. 6



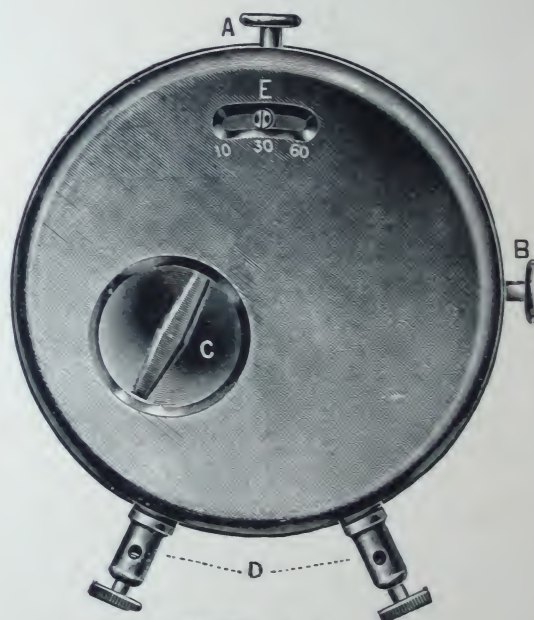
82578. 1:3.



82581. 1:2.



82579. 1:1.



82580. 1:1.

82578. **Seconds Clock**, Figure, in oak case, for calibrations and other purposes, with nonmagnetic clockwork insensitive to temperature changes, with two dials, graduated in 60 seconds and 30 minutes respectively. This clock goes eight days with one winding. Wood case about 7" long, 5" wide and 3 1/4" high

The pointers are alternately coupled and uncoupled to the mechanism by pressing down the left-hand button, such connection and disconnection being effected instantaneously, thus eliminating bulk errors in time-determinations. The pointers are brought to zero again by pressing the right-hand button.

82579. **Laboratory Stop Watch**, Figure, with non-magnetic action, for laboratories, test-rooms, calibrating and standardising institutions, etc. The clock goes for 20 hours with watch one winding. The working of the watch is very accurate, the winding device, the stop device and the return to zero being arranged independently of each other

The watch is started by pressing the button A, the perceptible point of pressure being slightly exceeded. A second pressure on the button A stops the watch again, the subsequent one setting it going, and so on. The pointers are returned to zero by pressing button B, the watch being wound by means of the button C at the back of the watch case.

82579a. — idem, with dial having a decimal scale from 1 to 100 seconds, as suggested by the German Society of Engineers

82580. **Laboratory Stop Watch with Electric Contacts** which are interrupted at definite time-intervals, Figure, with non-magnetic action and running for 20 hours with one winding

By means of the setting device E, the watch can be set for three different units of time, the contacts being broken at these specific times. The terminals D are for connecting the wires.

a) Contacts broken at 10, 30, 60 seconds

b) " " " 1/2, 1 and 2 minutes

c) Contacts broken at 1, 3 and 6 minutes

d) " " " 5, 10 and 30 "

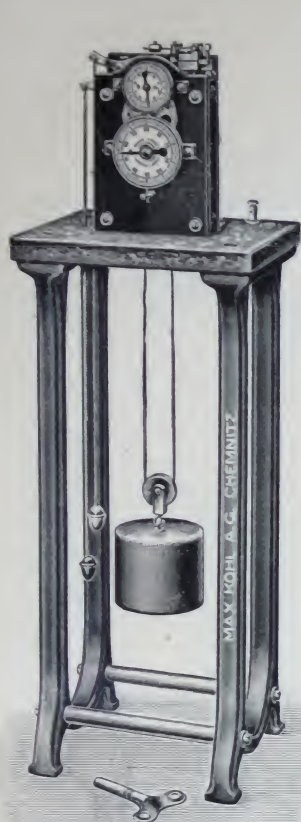
£ s. d.

6. 18. 0

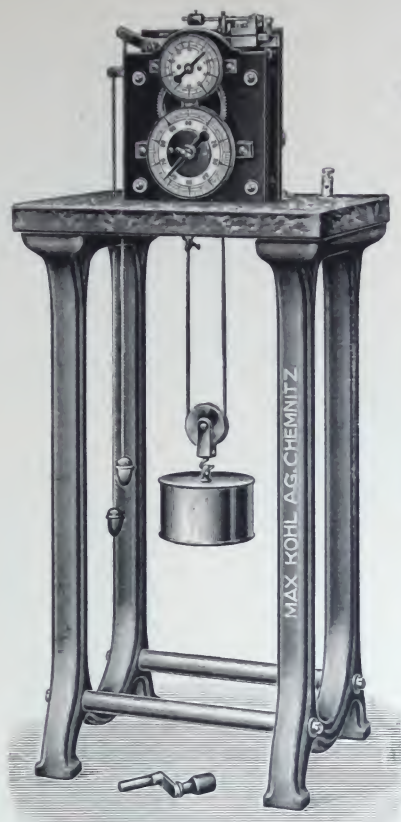
1. 3. 6

1. 3. 6

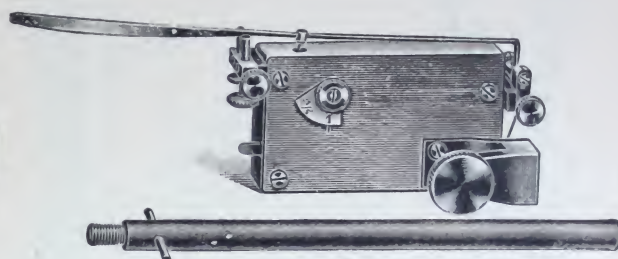
2. 7. 0



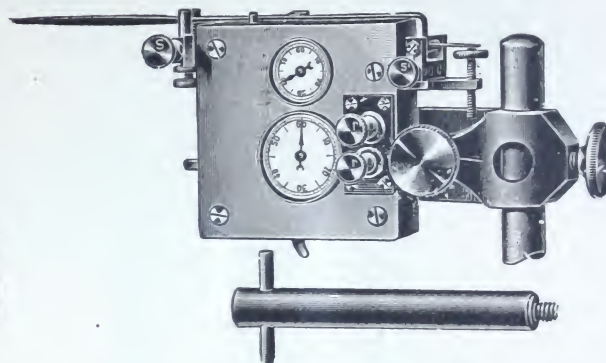
82583.



82584.



82586. 1:2.



82586 a. 1:2.

82581. Revolution Counter, Figure (on p. 1390), for accurately determining the number of revolutions per minute, average speed per minute, and linear velocities per minute after a time interval of 6 seconds. Arranged for measuring from 0—30 000 revolutions . . . £ s. d. 2. 7. 0

The clockwork is wound up and the pointers set to zero by pressing on the lever-button projecting from the casing. After the finger has found the point of resistance on the button, pressure is continued and increased, and the finger is suddenly released, so that the lever projects at full velocity from the casing. To indicate the direction of rotation of the measuring spindle and the pointer a black signal appears on the dial for clockwise rotation and a red signal for anti-clockwise.

One revolution of the large pointer equals 1000 revs., or, when the measuring roller is inserted, it equals 100 metres. One revolution of the small hand = 10000 revs. or 1000 metres when the measuring roller is inserted. Two further attachments, as well as the roller, are supplied with the instrument, viz: a pointed and a hollow attachment. Moreover, the triangular axial point of the instrument can be applied direct.

The measuring roller, having a periphery of 10 cm (about 4"), is used for measuring the initial or other velocity of rotating cylinders and hollow bodies. It is also used in cases where it is impossible to get at the end of the shaft, and where the revolutions are calculated from the peripheral velocity in accordance with the following conversion figures: 1 complete revolution of the measuring roll = 10 cm, 1000 revs. = 100 metres, 10 000 revs. = 1000 metres.

82582. — idem, suitable for measuring from 0 to 3000 revolutions. This instrument is specially suitable for use as a final counter for rapidly estimating the final speeds per minute of looms, etc. 2. 7. 0

This apparatus only differs from the foregoing by its smaller dimensions. Each scale-division of the large dial represents one revolution, so that a whole revolution of the large pointer is equivalent to 100 revs. of the machine, and a complete revolution of the small pointer equals 1000 revolutions of the machine.

82583. Chronoscope, (Hipp's), Figure, running for 6 minutes, with celluloid dust-protecting case. Reading from $\frac{1}{1000}$ ths of seconds on upper scale and $\frac{1}{10}$ ths seconds on the lower scale 22. 15. 0

This is an extremely accurate piece of apparatus for determining small intervals of time. It is used in the determination of the time of vibration of tones, the velocity of falling bodies, the time of flight of projectiles. The instrument records accurately to 0,001 second. The arrestment is released mechanically by means of two pull cords, or electrically by means of a double relay fitted on the back.

82584. — idem, Figure, running $1\frac{1}{2}$ minutes, with celluloid dust case . . . 17. 10. 0

82585. Demonstration Chronoscope for Lecture Rooms in universities, technical colleges etc. The dial, about 18" diameter, is visible a great distance away . . . 25. 15. 0

82586. Recording Chronometer, after Jaquet, Figure, for recording on paper from $\frac{1}{5}$ ths of seconds and whole seconds. In case . . . 5. 0. 0

- 82586 a. — idem, Figure, with two dials, for testing the accuracy of time records . . . 8. 5. 0
The lower lever sets the pointer to zero, and the left-hand lever stops the mechanism.



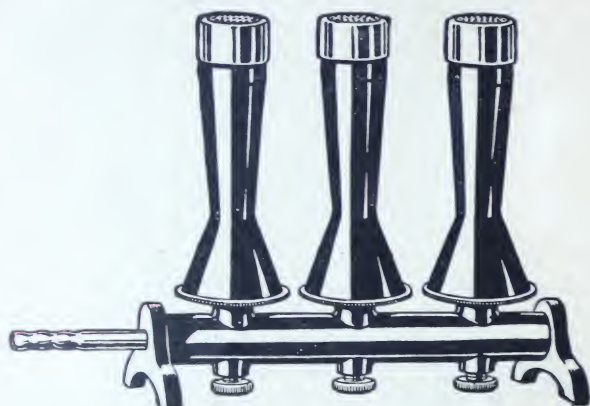
82588. 1:2.



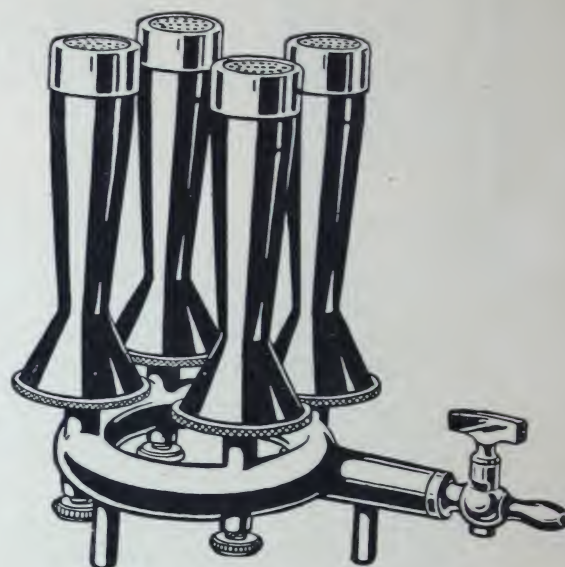
82597. 1:2.



82607. 1:2.



82603. 1:3.



82600. 1:2.

Max Kohl, Aktiengesellschaft, Chemnitz, Germany.

Franke Burners. These are excellent burners with burner heads of extremely refractory special fire clay, standing up very well to oxidation, acids and chemical reagents. The head absolutely cannot burn out. The gas and air are thoroughly mixed and perfect combustion of all combustible gases is ensured.

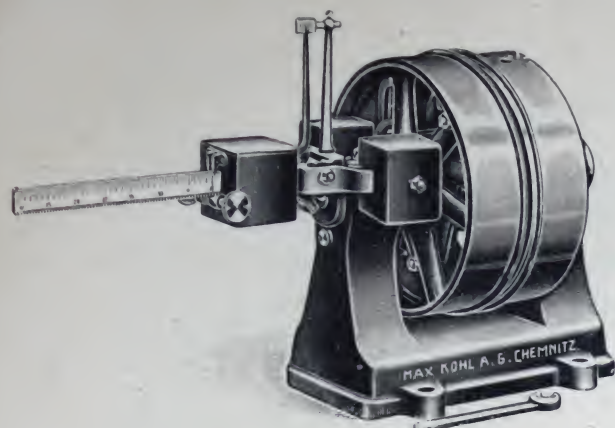
		Size I (Small)	Size II (Medium)	Size III (Large)
Diameter of Flame	mm	20	30	43
Laboratory Blue Flame Burner, Figure, with regulator for the air	{ List No.	82587	82588	82589
	{ Price £	0. 5. 5	0. 6. 0	0. 6. 7
— idem, with air Regulator and Cock	{ List No.	82590	82591	82592
	{ Price £	0. 6. 7	0. 7. 6	0. 8. 5
— idem, with Air Regulator, Tap and Pilot Flame	{ List No.	82593	82594	82595
	{ Price £	0. 7. 6	0. 8. 5	0. 9. 4
High Pressure Burners, Figure, with air regulator	{ List No.	82596	82597	82598
	{ Price £	0. 6. 7	0. 7. 6	0. 8. 5
Multi-Flame Franke Burners	3-Flame	4-Flame	5-Flame	6-Flame
Ring Burners, Figure, Burner Size II with Tap {	List No.	82599	82600	82601
	Price £	1. 10. 0	1. 14. 0	2. 1. 0
Series Burners, Figure {	List No.	82603	82604	82605
	Price £	0. 17. 0	1. 5. 0	1. 12. 0
				82606
				2. 0. 0

82607. **Laboratory Burner, Figure,** for chemical factories and chemico-technical works, laboratory and pharmaceutical work; highest efficiency, large heating area, low gas-consumption. Can be connected to any gas supply, and can be conveniently built into ovens and cookers, as illustrated

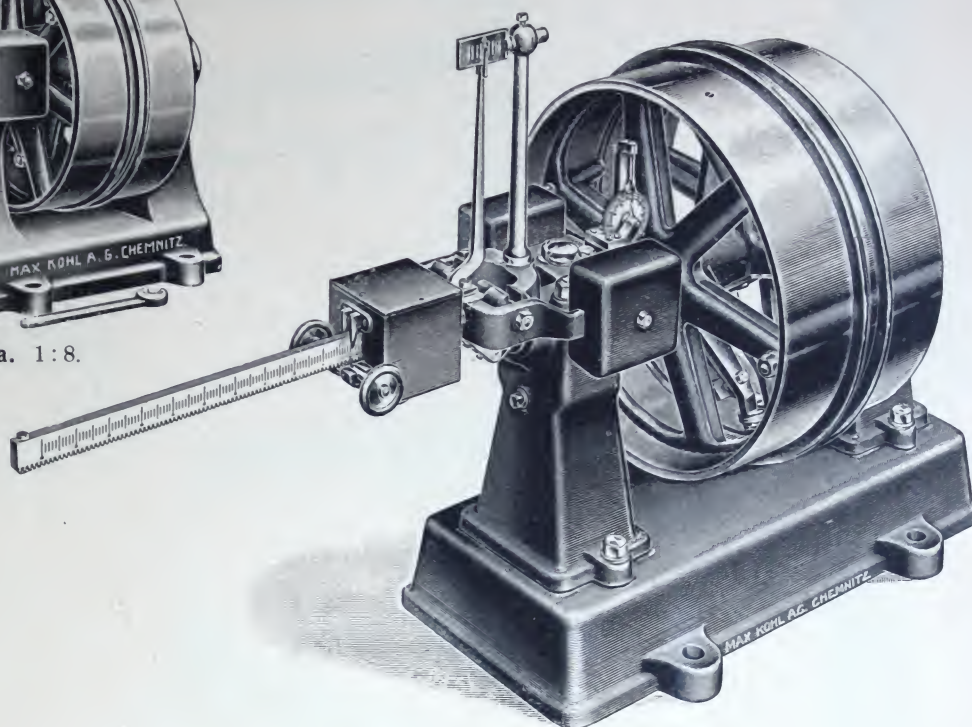
£ s. d.

0. 8. 6

When ordering, please give size of boiler.



51773 a. 1:8.



51774 a. 1:11.

Dynamometer (Fischinger's), Figure (Fr. phys. Techn. I, 2, Fig. 3292—3295 [I, Fig. 457—460]). This is a **Rotary Steelyard Dynamometer**, being arranged between the driving machine or shafting and the work machine by a belt drive, so that readings can be taken by a jockey weight after deducting for the tensile force of the belt.

List No.	Size	For Capacities to HP	For r. p. m. to	Tensile Force of Belt kg	Belt Speed m. per Second	Belt Pulley		Belt Thickness mm	Weight of Dynamometer ab. kg	Price £ s. d.
						Diam. mm	Width mm			
51773a	0	8	1600	30	20	240	55	3	50	40.0.0
51774a	1	30	960	100	24	480	110	4,5	270	70.0.0
51775a	2	60	720	200	24	640	230	6	600	100.0.0

This apparatus is used for measuring the expenditure of energy required for driving machines of all kinds, e. g., a loom, a spinning machine, wood planing machine, lathe, printing machine, etc., etc.

The dynamometer is connected by belting between the prime mover or its transmission and the driven machine whose efficiency it is intended to measure. The measurement is carried out easily by simply adjusting a rider weight. The pull K exerted by the belt is read off direct on the rider weight scale in kilograms. In order to take care of the energy consumed by the dynamometer itself, a further measurement is effected after the belt has been removed from the driven machine. Let the reading be represented by K' . The revolutions of the dynamometer are measured on a revolution counter fitted to it. Supposing the revs. per minute are called n , then the number of horsepower consumed by the machine is given by the following equation:

$$HP = \frac{n \cdot (K - K')}{C}$$

In this equation should be inserted the values K , K' and n as determined by the dynamometer, and the constant C corresponding to the size of dynamometer used.

The special advantages of this dynamometer may be enumerated as follows:

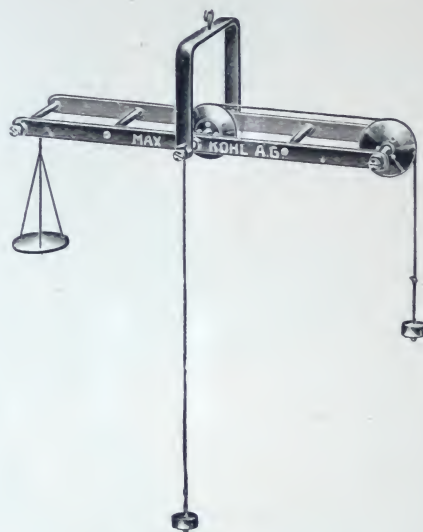
1. The elimination of springs such as are used in dynamometers of other systems. These springs do not remain constant and are subjected to different degrees of centrifugal force varying with the revolutions of the dynamometer, so that they impair the correctness of the measurement.
2. The high accuracy of the power indication, which is excellent even where small powers are involved.
3. The apparatus is very conveniently set up for measurements, and very few preparations are necessary.
4. The extraordinary range, reaching from the highest output of the largest model to the smallest powers.



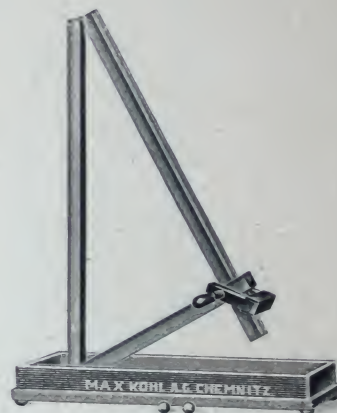
82 608. 1:18.



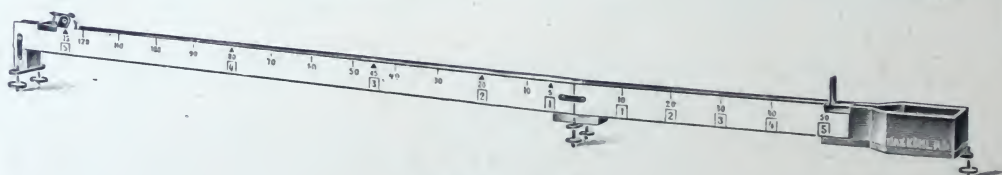
51 800. 1:9.



51 801. 1:6.



51 810. 1:17.



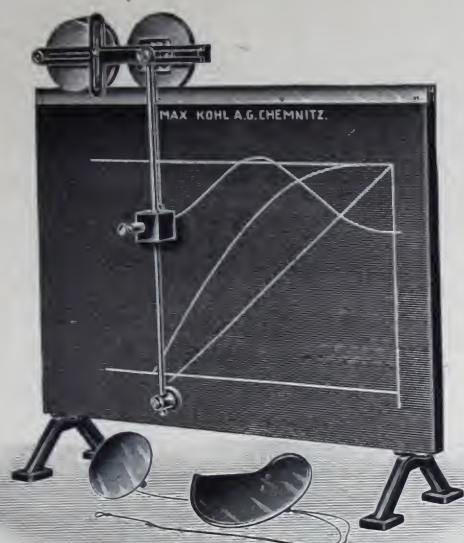
82 609. 1:14.

General Mechanics.

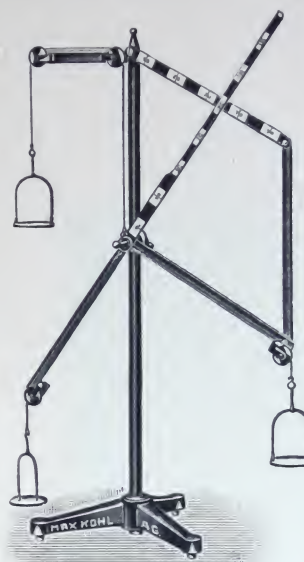
(Motion and Forces).

- | | |
|---|-------------------|
| 82 608. Fall Apparatus , after Grimsehl, with glass plate and tuning fork, Figure (See: E. Grimsehl, Lehrbuch der Physik 1909, p. 28); for measuring the paths traversed at equal intervals of time | £ s d.
3. 0. 0 |
| A recording tuning fork, set into vibration, registers the vibrations on a freely falling blackened plate. | |
| 51 800. Tension and Acceleration Meter (Hrabowsky's) [Ztschr. f. d. phys. u. chem. U. 9 , 1896, p. 24; Fr. phys. Techn. I, 2 , Figs. 3165 and 3166], for graphically demonstrating accelerated motion, for demonstrating the laws of fall, accelerated motion on a horizontal path, equable motion, final velocity, and retarded motion, Description , Figure | 5. 10. 0 |
| 51 801. Poggendorff's Balance (Fall Machine) for determining the force necessary for accelerating a body (Fr. phys. Techn. I, 2 , Fig. 3275), Figure | 1. 10. 0 |
| 51 810. Apparatus for demonstrating the Fall of a Body through the chord , Figure, simple, and without mechanical release (M. P., Fig. 118 [117]) | 1. 0. 0 |
| 82 609. Collapsible Fall Trough with Electrical Contacts , after Kolbe; Figure (Zeitschr. f. d. phys. u. chem. U., Vol. 26 , 1913, p. 353), for verifying the laws of fall | 4. 10. 0 |

Cl. 6853,
6295, 6303, 7200,
6946.



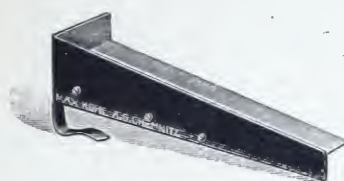
51819. 1:10.



51830. 1:7.



51839. 1:6.



82610. 1:3

51819. **Kinegraph** (Engelmeyer's), Figure, for recording compound motions, their components and resultants (Ztschr. f. d. phys. u. chem. U. 9, 1896, p. 134; Fr. phys. Techn. I, 2, Fig. 3176), Description £ s. d.
5. 10. 0

Of the two wheels of a carriage which moves along a rail, the right-hand rests loosely on its axis, whereas the left-hand wheel is firmly fixed to its axis. Upon the axis of the latter, or excentrically to it, different shaped discs may be fixed on to which a thread is wound when the carriage moves. To the thread is attached a weight fitted with a recording device, the weight travelling along a rail fitted to the axis of the loose wheel. The rail can be adjusted in its longitudinal direction. It is thus possible to show the parallelogram of movements, assuming any magnitude for the size and direction of the components, the motion of projectiles, sinusoidal motion (sinusoids) as the combination of a sine-oscillation and a uniform motion. Using other suitably shaped discs, any other curve in steady movement can be shown. (As regards the theory of these profiles, see "Journal de Physique, III., 1894, June, paper by Dr. Boleslas Młodzieiowski.")

51830. **Parallelogram of Forces Apparatus** (Bertram's), Figure, entirely of metal (Fr. phys. Techn. I, 2, Fig. 2154 [I, Fig. 114]), without weights, Description 2. 0. 0

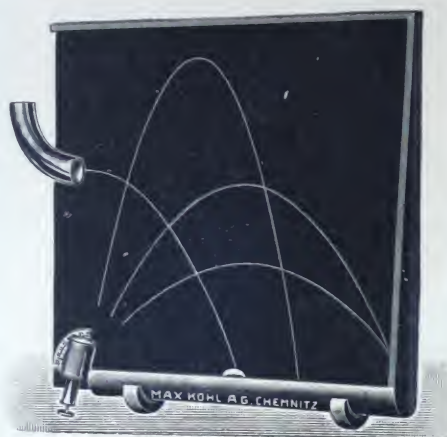
The apex of the parallelogram, about which the diagonal rotates, is formed by a horizontal pin. Above this pin is a ring to which the three forces are applied. The force directed perpendicularly upwards is always assumed to be 100 grams. If, now, the parallelogram is set so that the straight stretches are as 100:90:60, then, when 100, 90 or 60 grams are placed in the corresponding pans, the ring swings free without touching the pin.

51839. **Trajectory Apparatus**, after Hartl, for proving that a body projected horizontally falls in a given time through the same vertical distance as a freely falling body; with spring, for fixing to the wall, Figure (Ztschr. f. d. phys. u. chem. U. 2, 1888/89, p. 81) 0. 18. 0

A spring, forked below, and attached by three screws to the top of a wood frame, can be deflected from the vertical position of rest by means of a cord passed over a roller. The forward movement projects horizontally forward a small brass block placed on a small fork-shaped table about 3 to 4 mm behind the position of rest of the spring, and a brass ball, resting in the scooped-out portion of the block drops down vertically owing to inertia. Both the bodies, i. e., the block and the ball, strike the horizontal floor simultaneously.

82610. **Packard's Fall Trough** Figure (H. Sch. Fig. 122), with fixing clamps on the board . . . 0. 3. 0

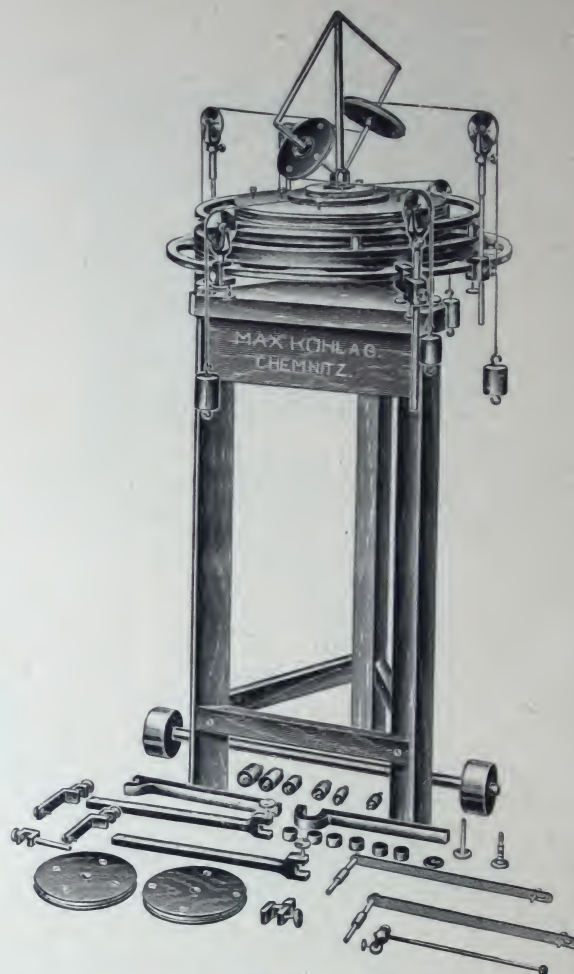
A small blackened ball is, allowed to roll down the trough, and when it reaches the slightly tilted board it describes a ballistic parabola.



51847. 1:12.



82611. 1:10.

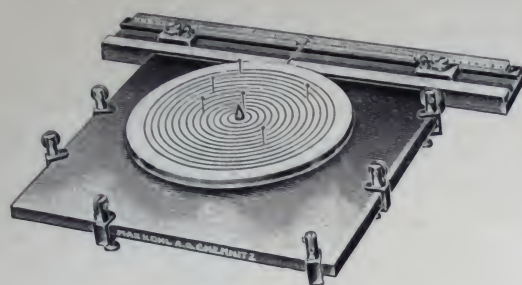


51857. 1:12.

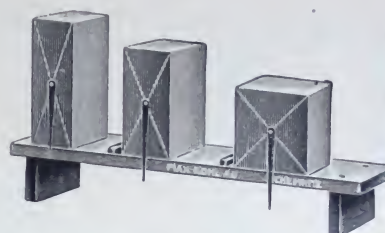
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|---|----------|
| 51847. Apparatus for showing the Projection Parabola (Ducruet's), Figure (Fr. phys. Techn. I, 2, Fig. 3185; Bohn, Physikal. App. No. 28, p. 25) | £ s. d. |
| The missile, a chalk ball, rolls out of an adjustable bent tube, or is cast out of a straight tube by means of a spring leaving the parabola traversed on a dead-black board. | 1. 15. 0 |
| 82611. Water Jet Projection Apparatus , after Rosenberg (Rosenberg, Experimentierbuch I, 1908, p. 100), Figure | 2. 10. 0 |
| The apparatus has three outflow pipes, which can rotate independently of each other, and which can be set and actuated simultaneously at different angles of elevation. In this way, it is possible to confirm not only the laws on the dependence of range and trajectory on the initial velocity and the angle of elevation, but also the law which postulates that "The range is the same for two angles of elevation which are complementary to each other at 90°." | |

Mechanics of Solids (Statics and Dynamics.)

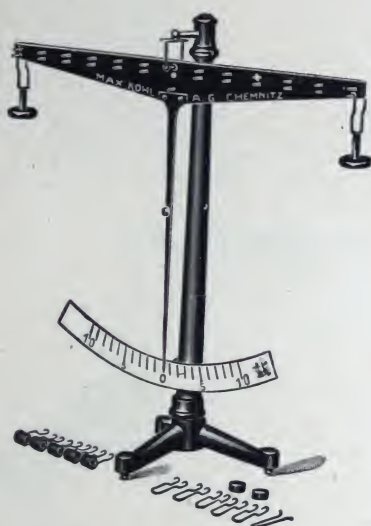
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| 51857. Demonstration Apparatus for the Statics and Dynamics of Rigid Bodies , Töpler's (Ztschr. f. d. phys. u. chem. U. 1, 1887/88, p. 137; Fr. phys. Techn. I, 2, Figs. 3278 to 3281), Figure, Description | £ s. d. |
| For proving the hypothesis of the plane polygon of forces, of equilibrium and of the centre of parallel forces, of the equilibrium of couples of force and any forces on the flat or in space, of the principle of virtual velocities, of the equilibrium of forces on a body rotating on a fixed axis or movable in a fixed direction; of the centre of momentum of motion, of progressive motion, of the action of the couple on the freely moving body, and of uniformly accelerated and oscillating Rotary Motion. | 21. 0. 0 |



82 612. 1:15.



51 929. 1:10.



51 935. 1:8.



51 986. 1:8.

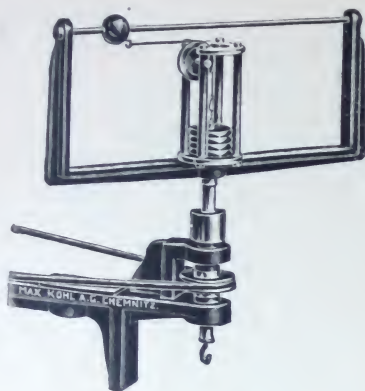
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|--|----------|
| 82 612. Torsional Moment Apparatus (Noack's), Figure, comprising moment of rotation disc and stand table for the disc, for proving the theorem of the moment of torsion, static moment, moment of rotation. (Noack, Aufg. Fig. 14) | £ s. d. |
| | 4. 15. 0 |
| 51 929. Board with 3 Prismatic Blocks of various heights for stability experiments (Kleiber, Lehrb. d. Phys., Fig. 37), Figure | 0. 12. 0 |
| 51 935. Weigh Beam Model, with pointer and scale , Figure (W. u. E., phys. Prakt. Fig. 27), for investigating the dependence of the sensitivity of a balance on the load, the beam length, the distance of the centre of gravity from the point of suspension and the weight of the beam (the C. G. remaining constant), Description | 1. 10. 0 |

Accessory Apparatus for Whirling Tables.

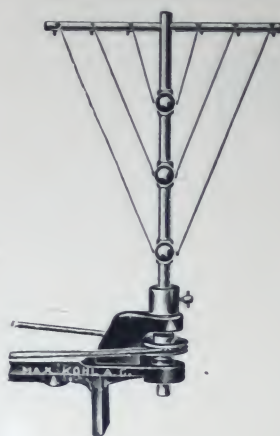
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|---|----------|
| 51 986. Spring Balance , Hartl's, for measuring the centrifugal force (Ztschr. f. d. phys. u. chem. U., 10, 1897, p. 123; Fr. phys. Techn. I, 2, Fig. 3204), Figure | £ s. d. |
| | 2. 10. 0 |

The spiral spring is coaxial to the axis of rotation, and the scale, with reading device, with its alternate black and white colouring, is so arranged as to give easy reading even at the most rapid rotations.

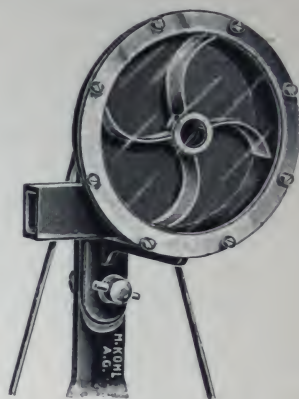
Cl. 6800, 6966,
6881, 6848.



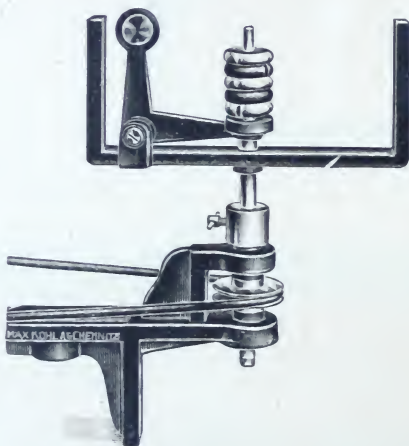
82613. 1:7.



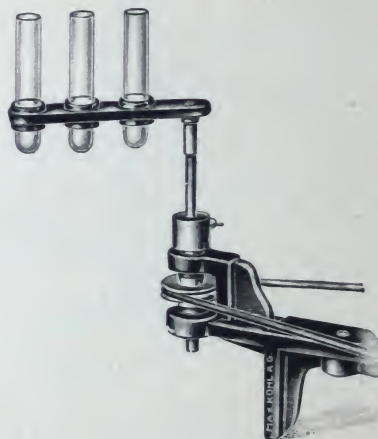
51981. 1:8.



52004. 1:5.



51984. 1:5.



51998. 1:5.

82613. **Centrifugal Balance** after Frick, Figure (M. T., Fig. 39), for testing the dependence of centrifugal force on the radius and the peripheral velocity £ s. d.
1. 0. 0

51981. **Pendulum Ball Balance**, after Fuchs, Figure, with double-thread pendulums of different length (Ztschr. f. d. phys. u. chem. U. **16**, 1903, p. 343; Frick phys. Techn. I, 2, Fig. 3322) 0. 10. 0

The gradual increase in rotational velocity causes the two lower balls to reach the level of the top-most ball, and when this velocity is still further increased, all three balls are raised so as to be always at the same level.

51984. **Ball Crank Lever Apparatus** (Fr. phys. Techn. I, 2, Fig. 3203 [I, Fig. 426]), Figure. This is a simple device for explaining the laws of centrifugal force 0. 16. 6

51998. **Whirling Table Attachment, with 3 Independent Tubes** (M. T. Fig. 42, Figure 0. 12. 0

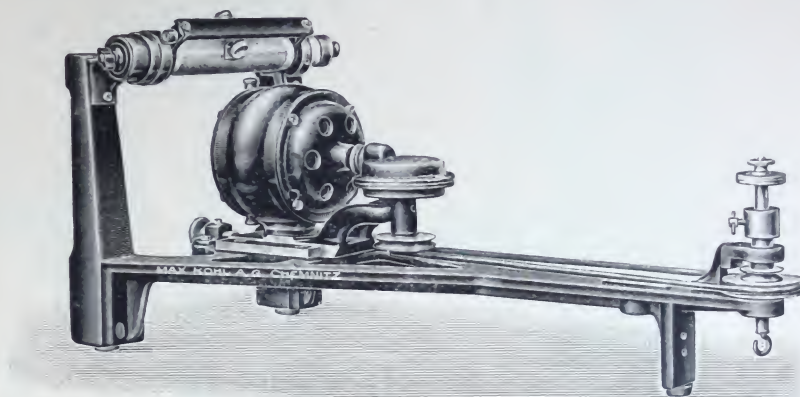
The three tubes, of the same diameter, are first of all filled to the brim with water. Since, when the tubes are rotated, the free areas in each tube must be such that their inclination is equal to that of the parabolic area, a certain amount of water is projected from each tube. When the apparatus is at a standstill, the levels drop, in a straight line outwards, as the tangent of inclination at a given speed (rotational) is simply proportional to the whirling radius.

52004. **Model of Ventilator**, better construction, one wall glazed, Figure 1. 5. 0

Whirling Tables with Electric Motor Drive.



82614 A. 1:8.



82614 B. 1:8.

In the case of hand-driven Whirling Tables the speed and power can be chosen at will. If, however, the whirling table is driven by an electric motor, it generally runs at too great a speed for most experiments. If the speed of the motor is decreased by inserting a resistance, the power applied to the axis is correspondingly reduced, and, in addition, the speed is influenced in various manners by

friction. A satisfactory mode of driving is therefore unobtainable in this manner. These conditions are considerably ameliorated by our fitting the machine with simple intermediate gearing which considerably decreases the speed of the motor.

The axis of the countershaft gear wheel is fitted with a double cord pulley of two different diameters. The axis of the whirling table has also a double cord pulley. By means of the cord pulley, the gear wheel on the shaft of the whirling table can be geared low or high, thus varying the speed of the machine. The speed of the motor can be further regulated within wide limits by a controlling resistance. The motor is wound in such manner that the power developed varies very little in spite of the decrease in revolutions.

The whirling table has a **massive iron frame** and can be used both vertically and horizontally. Fig. 82614 A shews the whirling table arranged vertically, ready for use and for taking a colour disc, siren discs, or the like; while Fig. 82614 B shews the machine placed horizontally. The arrangement of the axis and the fixing of the auxiliary apparatus are the same as before. Auxiliary apparatus already available fit this machine without any alteration.

The **Electric Motor** is fixed to the frame of the whirling table by means of a slider. The slider can be moved by a screw, thus allowing the driving cord to be tightened or loosened. The regulating resistance, a switch and a plug box are firmly fixed on the frame. This arrangement combines everything necessary for working and the machine can be connected at once to the electric supply.

The manipulation of the Whirling Table fitted with electric motor has been found to be most convenient since the experimenter has both his hands free.

The arrangement of this machine presents the further advantage that the motor can be used, without removing it from the stand, for driving the influence machine or other apparatus, and this at any speeds.

Whirling Tables with D. C. Electric Motor Drive, Figs. 82614 A and B, with electric motor, compound wheel gearing, regulating resistance, switch, plug contact.

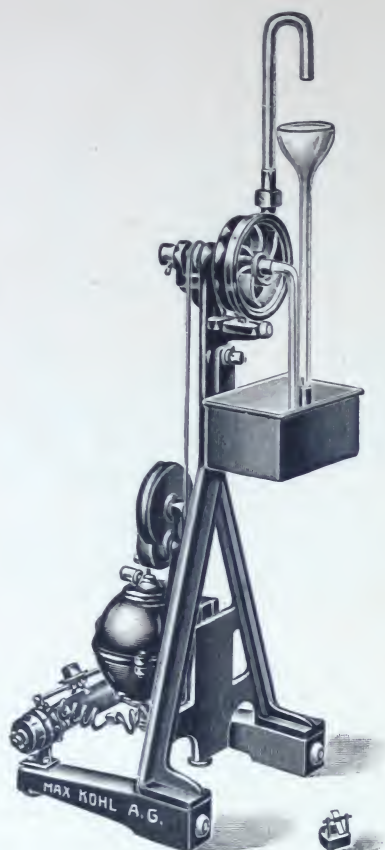
With D. C. Motor	} of HP	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{8}$
		Pressure, Volts	110	110	220
		List No.	82614	82615	82616
		Price, £	7. 0. 0	8. 0. 0	7. 10. 0

If pressure is different from above the prices are varied accordingly.

Whirling Tables with A. C. motor drive with electric motor, compound wheel gearing, regulating resistance, switch, plug contact, for connecting up to an A. C. network or to **one** phase of a three-phase supply.

With A. C. Motor , Frequency 50 (100 pole alternations per second)	} of HP	$\frac{1}{10}$	$\frac{1}{10}$
		Pressure, Volts	110
		List No.	82618
		Price, £	9. 10. 0

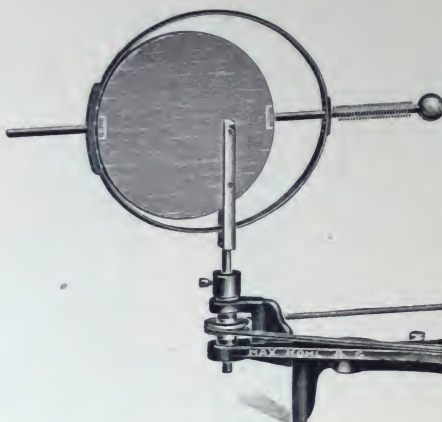
	} of HP	$\frac{1}{10}$	$\frac{1}{10}$
		Pressure, Volts	220
		List No.	82619
		Price, £	10. 0. 0



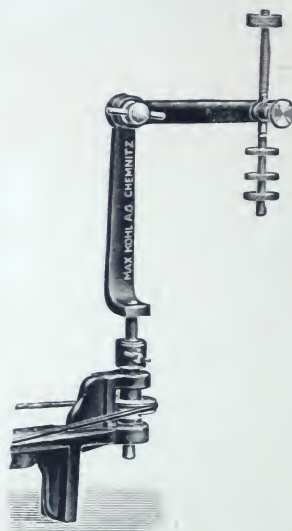
52005. 1:10.



52014. 1:4.



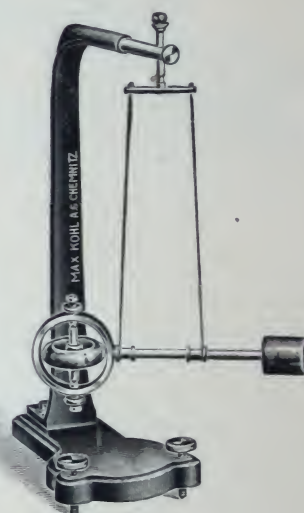
82620. 1:9.



52007. 1:6.

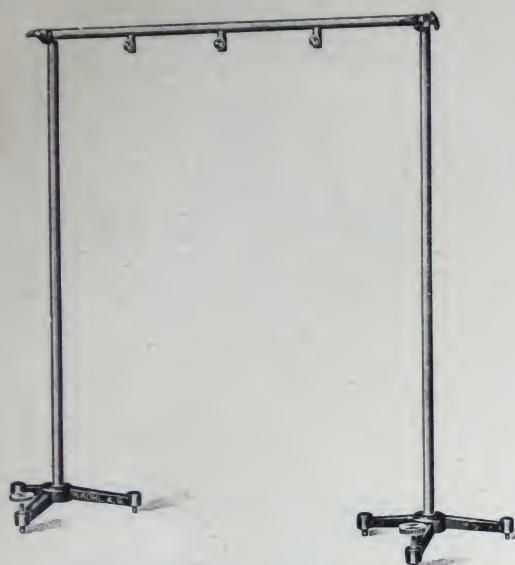


52085. 1:4.



52097. 1:5.

52005. **Centrifugal Pump and Centrifugal Blower** Hartl's (Ztschr. f. d. phys. u. chem. U., **10**, 1897, p. 125), Figure £ s. d.
2. 15. 0
52007. **Apparatus for Stable and Unstable Axes** (Hartl's), masses adjustable, for varying the centre of gravity and moment of mass (Ztschr. f. d. phys. u. chem. U. **10**, 1897, p. 122; Fr. phys. Techn. I, **2**, Fig. 3224, 3225), Figure 2. 0. 0
52014. **Pendulum**, with a dissymmetric system of masses (M. T., Fig. 40); Figure 0. 4. 0
If the mass-system is suspended at its centre of gravity and then rotated, the suspension wire remains in its place. If, however, the mass is suspended at a point adjacent to the centre of gravity, the thread describes the outer surface of a cone, while the centre of gravity remains, as before, the point of rotation of the system.
82620. **Apparatus for demonstrating Ebb and Flow** (as suggested by Hils); Figure 1. 12. 0
The circular wood disc, which rotates about an excentrically placed axis passing through the centre of gravity of the system earth-moon, and which carries two brass rods in prolongations of the horizontal diameter, represents the earth. A circular steel band represents the aqueous envelope of the earth, and espouses the edge of the above disc, being concentric to it when in rest in the vertical position. It does not actually touch the disc but is offset an inch or so, rotating about the brass rods. At the end of one of the brass rods is firmly fixed a brass ball. This is fixed to the steel band by a spiral spring sliding on the brass rod. This ball represents the moon. By rotating the apparatus at a moderate speed on the whirling table the steel band is lifted more at the sides turned towards and away from the brass ball, whereas at the poles it approaches the wood disc.
52085. **Curve Top** (Koppe's) (Ztschr. f. d. phys. u. chem. U. **4**, 1890, p. 80; Fr. phys. Techn. I, **2**, Fig. 3244), Figure 2. 10. 0
52097. **Alternating Gyroscopic Tree** (Gruey's), Figure, the top being rotated by its own weight instead of by rubber cords 5. 0. 0



82 621. 1:12.



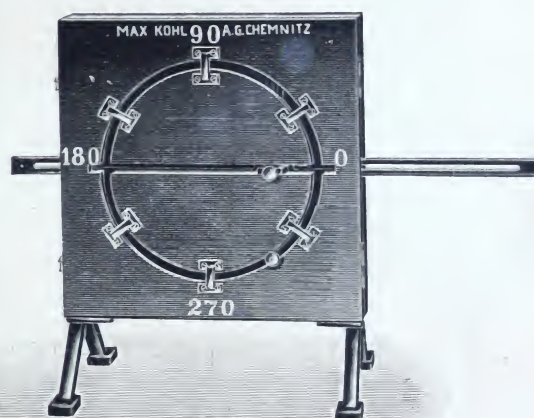
52 111. 1:13.



82 622. 1:14.



82 624. 1:10.

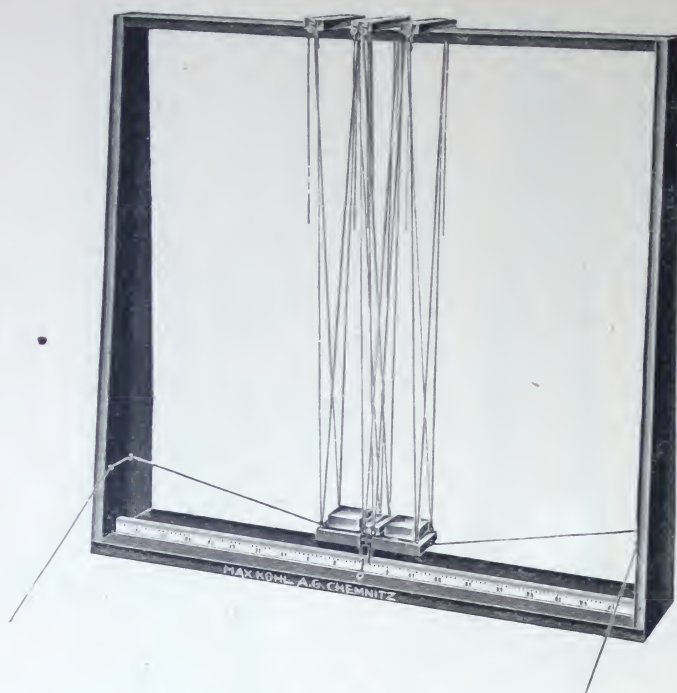


82 623. 1:9.

- | | |
|--|----------|
| | £ s. d. |
| 82 621. Pendulum Stand (Noack's), Figure (See: Leitf., Fig. 1, problems 36, 37) | 1. 10. 0 |
| 52 111. Demonstration Pendulum (reversible) , of brass and iron, for showing the laws of motion of the compound pendulum, swing $1\frac{1}{2}$ seconds, with stand, Figure, Description | 6. 5. 0 |
| 82 622. Pendulum , as suggested by Whiting, Figure, with accessories (H. Sch., Fig. 119), for proving the correctness of Galileo's space-time law of a freely falling body, and for determining approximately the acceleration due to gravity | 1. 4. 0 |
| 82 623. Apparatus for Demonstrating Simple Oscillations , as suggested by Bergmann; Figure (Ztschr. f. d. phys. u. chem. U., 1887, p. 25) | 4. 10. 0 |

By simple oscillations, we mean periodic movements of a point on a straight line, the distance of the point from a given position of equilibrium and its velocity at any moment being capable of representation as a sine-function of time (sine oscillation). As the apparatus demonstrates, a similar motion carries out the projection of a circular point on the diameter of the circle, when the point of the circle traverses the circumference of the circle at uniform velocity.

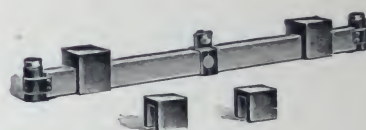
- | | |
|--|----------|
| 82 624. Apparatus for Showing the Porosity of wood , Figure (W. D., 5 th Edn., 1913, p. 68) | 0. 10. 0 |
|--|----------|
- The axis of the wood cylinder corresponds to the direction of the fibres of the wood, so that when air is blown through the apparatus it escapes at the lower end through the water in the form of numerous bubbles.



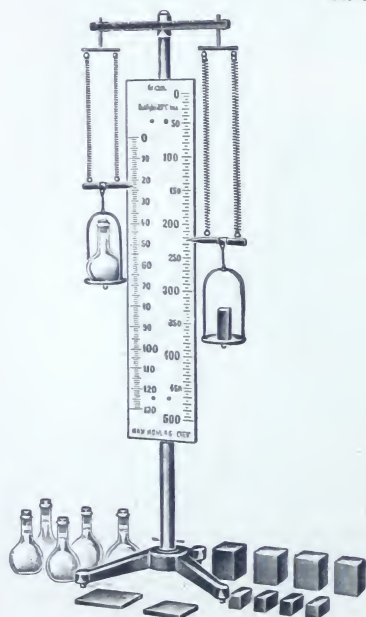
82 625. 1:14.



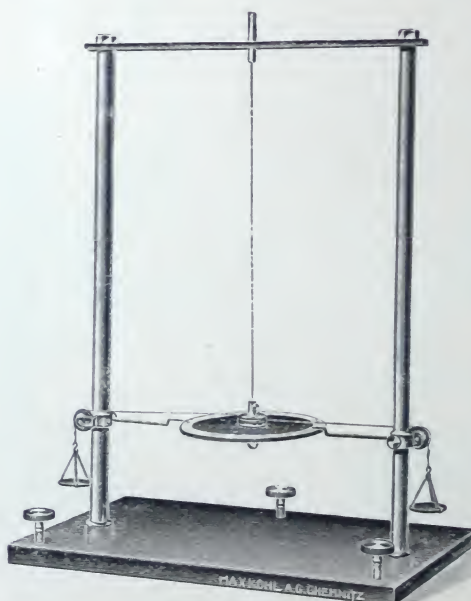
82 626. 1:5.



82 627. 1:10.



82 628. 1:12.



82 629. 1:10.

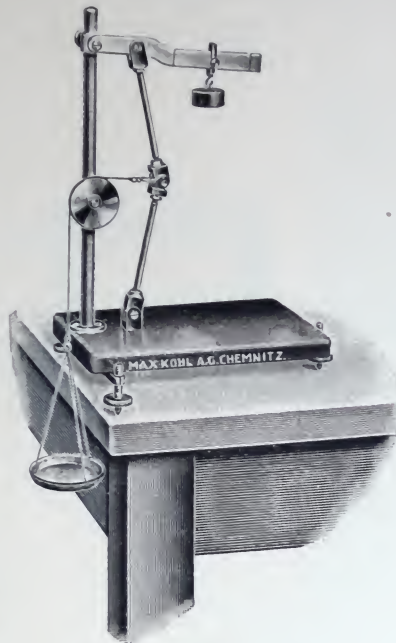


82 630. 1:5.

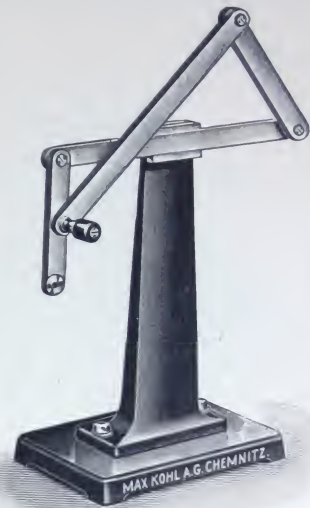
- 82 625. **Impulse Balance** (as suggested by Hicks), Figure, for determining the mass of a body (H. Sch. Fig. 131) £ s. d.
1. 2. 0
- 82 626. **Apparatus**, Figure (H. Sch., Fig. 125 and Fig. 148), for determining the moment of rotation and the force of a suspended wire by measuring mass, length and time 0. 12. 0
- 82 627. **Device**, Figure, with lead rider and zinc cylinder (H. Sch. Fig. 150) for investigating the moment of inertia of a body in terms of the masses of its several parts and their distance from the axis of rotation 0. 15. 0
- 82 628. **Double Spring Balance** (Kolbe's), Figure (Ztschr. f. d. phys. u. chem. U. 25, 1912, p. 144), for determining the specific gravity of solids and fluids 4. 10. 0
- 82 629. **Torsion Stand**, with 2 Rollers and 2 Weigh Pans, Torsion Circle and Torsion Body (drum), Figure, and including three thin steel wires of different thicknesses with thick brass ends, for determining the torsional force of steel wires 3. 4. 0
- 82 630. **Spring Balance with Weigh-Pan** (Dynamometer), Figure, of brass, plated 1. 0. 0



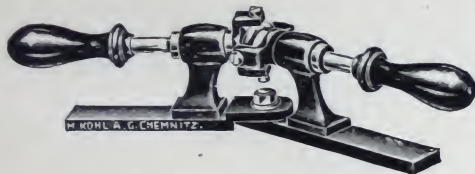
82631. 1:6.



52261. 1:8.



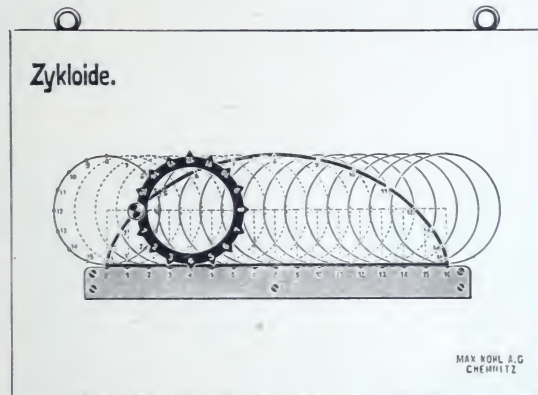
82632. 1:6.



52272. 1:5.



52319. 1:10.



52293. 1:10.



52320. 1:7.

Models of Machine Elements and Parts and of complete Machines.

Machine Elements and Simple Machines.

82631. Screw Jack , Figure, for determining ratio of travel, gear ratio, efficiency and friction of the screw jack. (See: H. Sch., Fig. 103)	£ s. d.
52261 Model of the Bent Lever , Figure (Fr. phys. Techn. I, Figs. 124—126; M. P. I, Figs. 280—282); testing of same by suspending weights. Price without weights	1. 8. 0
52272. Cardan Coupling for transmitting a rotary motion at any angle, of metal, Figure	3. 0. 0
52293. Model Table of a Cycloidal Gear System , containing a movable model and the precise constructional drawing of the gear (ratchet with toothed wheel), Figure	1. 5. 0
52319. Two Cam-shaped Cogs with Excentric Axes for periodic movements, Figure	2. 10. 0
52320. Two Toothed Wheels with Excentric Axes for alternately producing accelerated and retarded motions, Figure	7. 10. 0
82632. Cylindrical Cranked Rectangle , Figure. These are coupled cylindrical cranks	6. 0. 0
	4. 0. 0

Cl. 6058, 6998, 7180,
6328,
6270, 7246, 6273.



82633. 1:5.



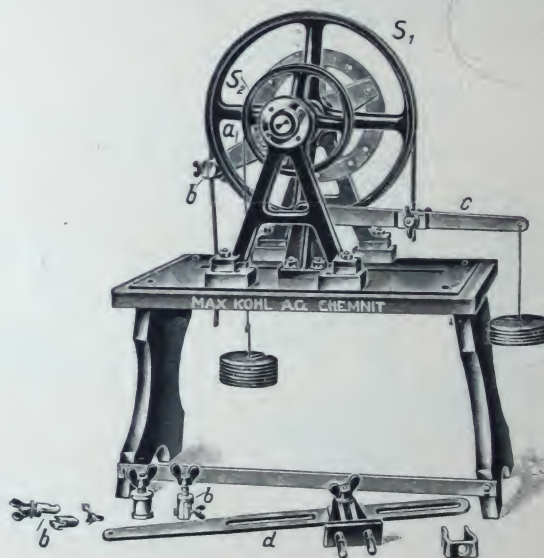
52392. 1:9.



82634. 1:6.



52370. 1:8.

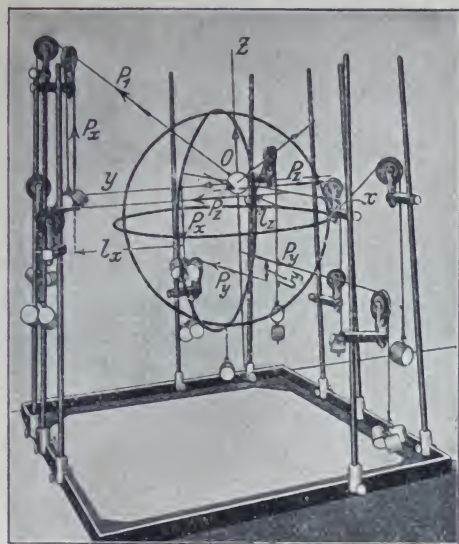


82635. 1:12.

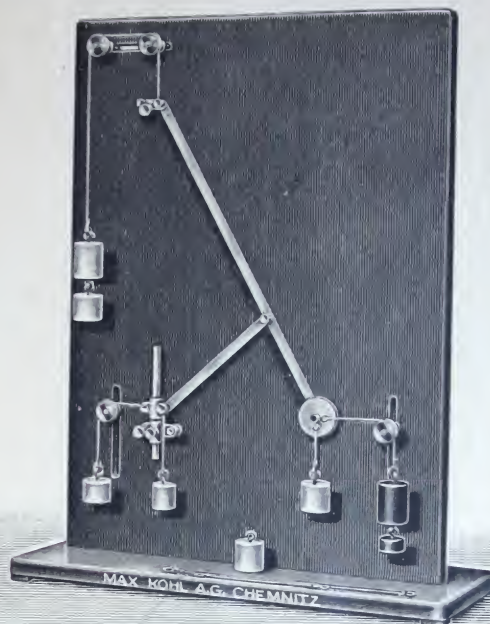
	£	s.	d.
82633. Spherical Wheel, with bent rack, Figure	3.	15.	0
52370. Coupling with Brake and Claws, for engaging slowly and smoothly by friction and firmly coupling by means of the claws, Figure	7.	10.	0
52392. Simple Windlass, of wood, Figure	0.	12.	0
82634. Model of a Differential Band Brake, Figure	3.	0.	0
82635. Model of a Band Brake as suggested by Prof. Rich. Vater (Figure), for various angles of contact	12.	10.	0

A compound lever *a*, which can be fixed by screws to the securing ring (which has 12 holes and is fixed to the supporting trestle) so as to provide various angles of contact or espousement for the band brake, is fitted freely on the axle and is fitted at one end with the clamping device *b*. Round the pulley *s*₂, fixed on the axle, is placed a belt or the like, the end of this which hangs down from the pulley carrying the load (a weight) whose motion is to be retarded. The method of action of a differential brake can also be demonstrated by replacing the single-armed brake-lever *c* by a double-armed lever *d* carrying two movable clamping devices.

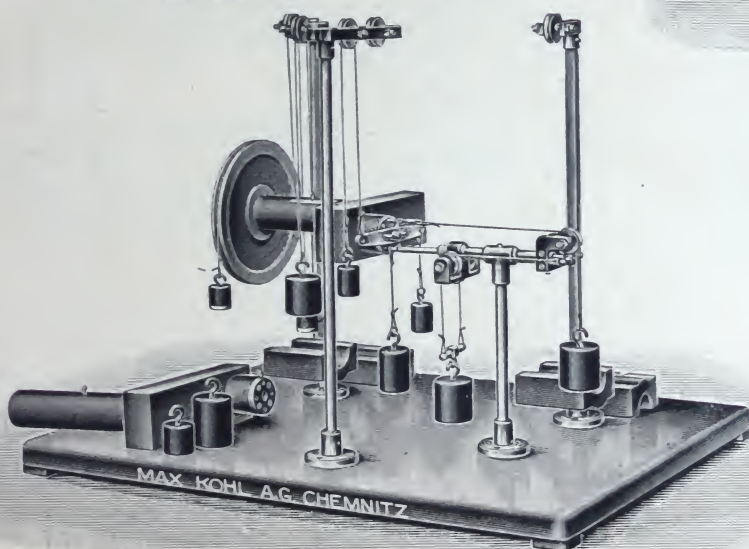
Models for Explaining the Principal Laws of Applied Mechanics, as suggested by Prof. Eugen Meyer, Charlottenburg.



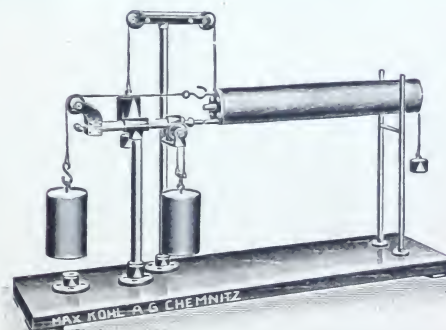
51833. 1:16.



82636. 1:14.

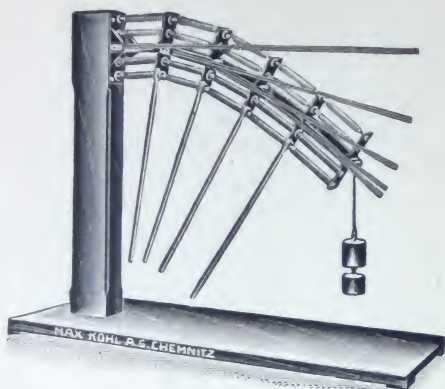


52180. 1:13.

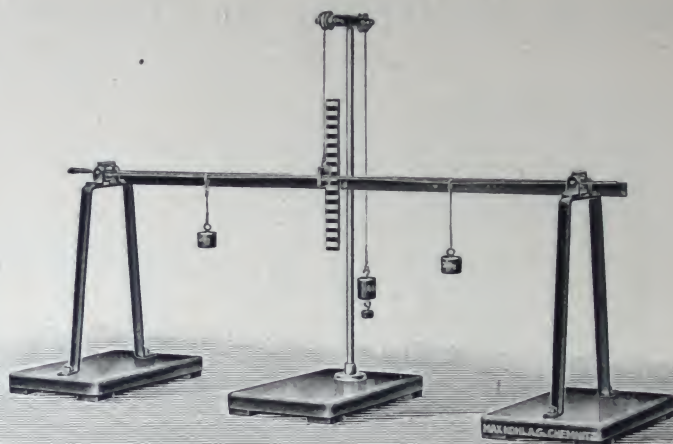


52179. 1:20.

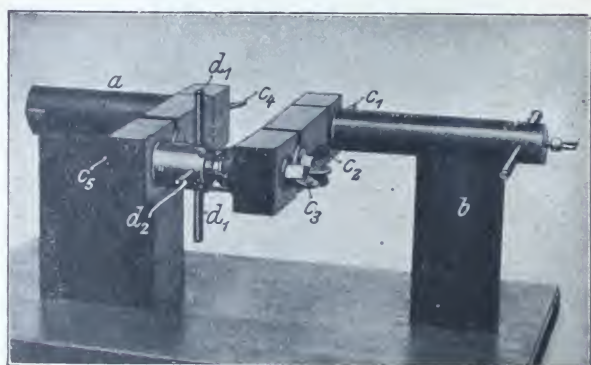
51833. **Model (No. 1) for combining forces in space**, Figure (Ztschr. d. V. d. I. **53**, 1909, pp. 1301 et seq., **No. 1**, et text-sheet 13, Figs. 1—3); **Description** £ s. d.
8. 0. 0
82636. **Model (No. 2) for explaining the equilibrium of forces in a Centrifugal Governor**, Figure; **Description** 6. 15. 0
52179. **Model (No. 3) for demonstrating the Bending Stress of a Straight Bar fixed at one end, Transverse Strength Apparatus**, Figure, for explaining the calculation of the transverse strength of straight bars, also for explaining the conception of bending moment (Z. d. V. d. I. **53**, 1909, p. 1301 et seq., **No. 3**, and text-sheet 13, Figs. 7 and 8); **Description** 6. 15. 0
- The wire maintained in tension at one end is loaded at the other end. The end of the bar in the clip is then moved up to a nick F, at which the bar can be dismounted; and forces of such direction and magnitude are applied to the loaded portion that the portion of the bar in the original position is again in a state of equilibrium, Figure.
- 52180 **Model (No. 4) showing the Stresses set up in the Cross-sectional Area of a Crank Pin. Bent Crankshaft**, Figure, a model for demonstrating the bending moment, the turning moment and the thrusts in a crankshaft (Z. d. V. d. I. **53**, 1909, pp. 1301 et seq., **No. 4**, and text-sheet 13, Figs. 10—12); **Description** 10. 15. 0
- The crankshaft can be divided in the centre of the crank pin in order to explain the actions of the individual forces at this section.
- One half of the crank shaft is taken forward, the other half being again brought to a state of equilibrium in the original position by the introduction of single forces and couples, after removing the bearing, so that all forces present and their action can be plainly demonstrated.



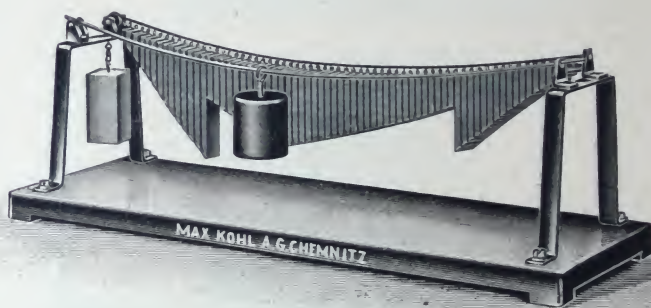
52181. 1:15.



52183. 1:18.



52182. 1:10.



52184. 1:10.

52181. **Model (No. 5) showing the Deformation in a straight Bar under Bending Stress**, Figure, consisting of a bar formed of a number of parts held together by springs which when loaded on one side form the elastic line as a polygonal line (Ztschr. d. V. d. I. **53**, 1909, pp. 1301 et seq., **No. 5**, and text-sheet 13, Figs. 13—15); **Description**

£ s. d.
6. 15. 0

Instead of using the steel springs a brass spring can be used whose coefficient of expansion is greater than that of the steel springs, so as to be able to analyse the conditions in the bending of cast iron bars. Wood bars can be placed on the model which become as tangents on the elastic line or which give the direction of the radius of curvature of the elastic line.

52182. **Model (No. 6) Crankshaft with moving parts**, Figure, for explaining the deformation of a crankshaft (Ztschr. d. V. d. I. **53**, 1909, pp. 1301 et seq., **No. 6**, and text-sheet 14, Figs. 16—22); **Description**

5. 5. 0

The model is provided with joints at the sections to be considered, so that the deformations caused by all the prevailing forces can be shown separately.

52183. **Model (No. 7) for Determining the Statically Indefinite Forces on a Bearing**, on a bar with three bearing surfaces, Figure (Ztschr. d. V. d. I. **53**, 1909, pp. 1301 et seq., **No. 7**, and text-sheet 14, Figs. 23—25); **Description**

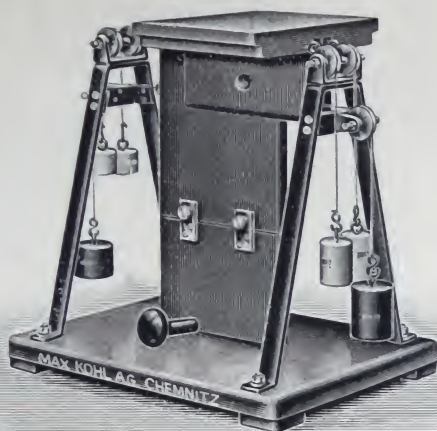
4. 10. 0

We will assume that the magnitude of the bearing force in the centre of the bar loaded as in the illustration with P_1 and P_2 is to be determined. The centre bearing is taken away and the sag caused in the middle is measured by P_1 and P_2 ; P_1 and P_2 are then shifted and a force W is applied to the centre which tends to bend the bar in an upward direction just as much as it was bent downwards by P_1 and P_2 . If P_1 , P_2 and P_3 are applied simultaneously the resultant deflection is obtained from the algebraic sum of both at zero.

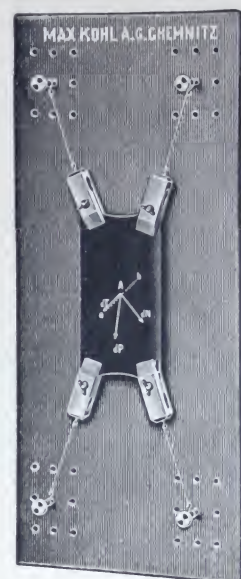
52184. **Model (No. 8) for Demonstrating Mohr's Law regarding the Elastic Line**, Figure (Ztschr. d. V. d. I. **53**, 1909, pp. 1301 et seq., **No. 8**, Fig. 27, and text-sheet 14, Fig. 26); **Description**

5. 10. 0

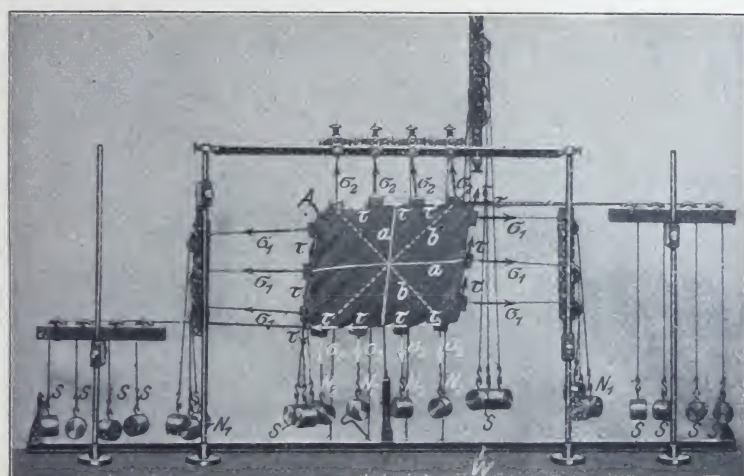
The bar resting freely on bearings at the points a and b, loaded with the weight P , assumes the same elastic line as the chain carried over the same bearing, since its horizontal tension is equal to the modulus of elasticity, and as the line of load of the chain is equal to the line of the $\frac{M_0}{I}$ determined for the bar.



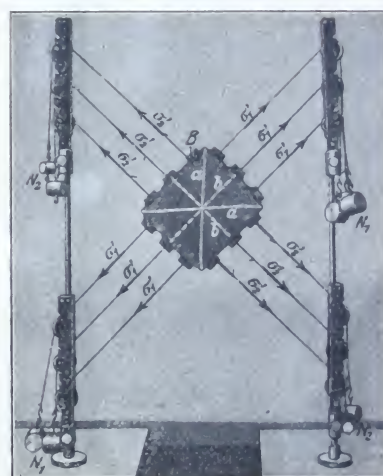
52185. 1:10.



52188. 1:10.



52190. 1:13.



52191. 1:12.

52185. **Model (No. 9) showing the Rivet and Shearing Stresses in a Double-T Joint built up of sheets and angle-iron**, Figure, for explaining the strain on the chord rivets and the shearing stress in compound girders which are subjected to a bending strain (Ztschr. d. V. d. I. **53**, 1909, pp. 1301 et seq., **No. 9**, Figs. 31 and 32, and text-sheet 14, Figs. 28-30); **Description** £ s. d.
5. 5. 0

The rivet submitted to the different stresses can be taken out and the shearing or compressive stress present in the cross sections ee, ff, and which the rivet must take up can be ascertained by a lateral movement of the angle iron with the chord piece opposite the web sheet. In like manner the shearing force present in the section gg can be shown by loosening the connection.

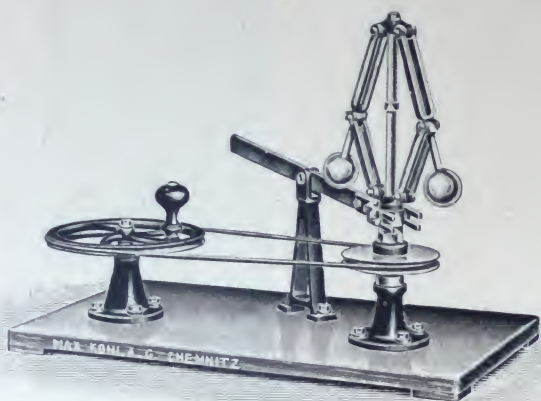
52188. **Model (No. 11) for Explaining Tension**, Figure (Ztschr. d. V. d. I. **53**, 1909, pp. 1301 et seq., **No. 11**, Fig. 35, and text-sheet 14, Fig. 35); **Description** 1. 15. 0

The rubber plate submitted to the forces P_1 , P_2 , P_3 and P_4 has a cut in the direction a—b and forms a gab. The division into normal tension and shearing stresses of the forces working on the cut is explained.

52190. **Model (No. 13) for Demonstrating the Deformation of a Parallelepipedic Body on the end surfaces of which normal shearing stresses act simultaneously**, Figure (Ztschr. d. V. d. I. **53**, 1909, pp. 1301 et seq., **No. 13**, and text-sheet 13, Fig. 42); **Description** 10. 0. 0

A base plate (angle iron W) can be raised and thus intercepts all the weights, and accordingly the elastic slab is unloaded and it assumes its original rectangular shape.

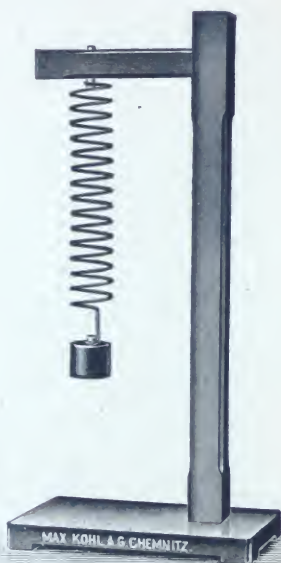
52191. — idem, Figure, constructed as per **Fig. 43** in the publication mentioned 6. 5. 0



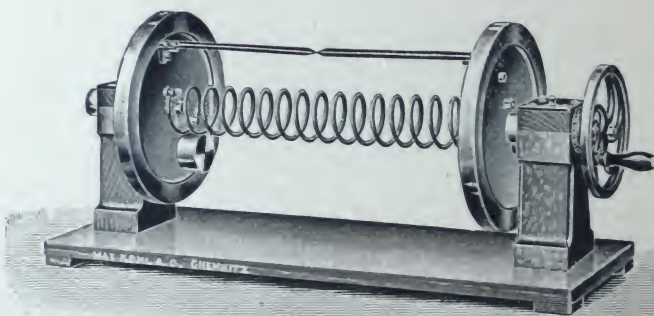
51946. 1:12.



52076. 1:13.

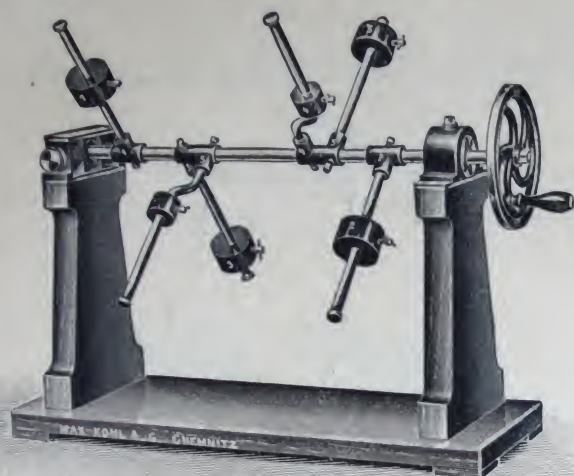


52120. 1:14.

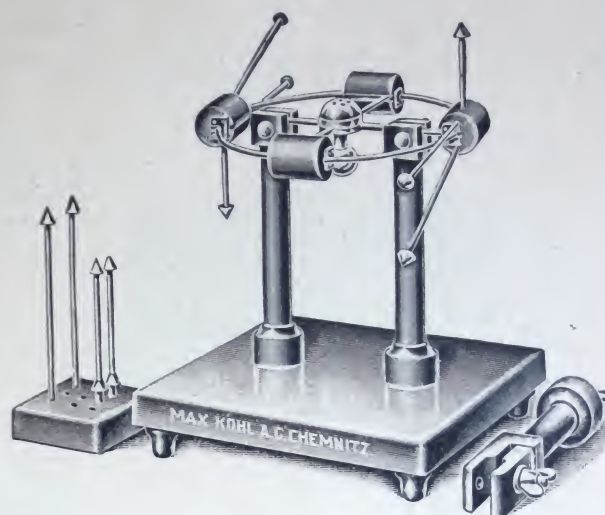


52142. 1:14.

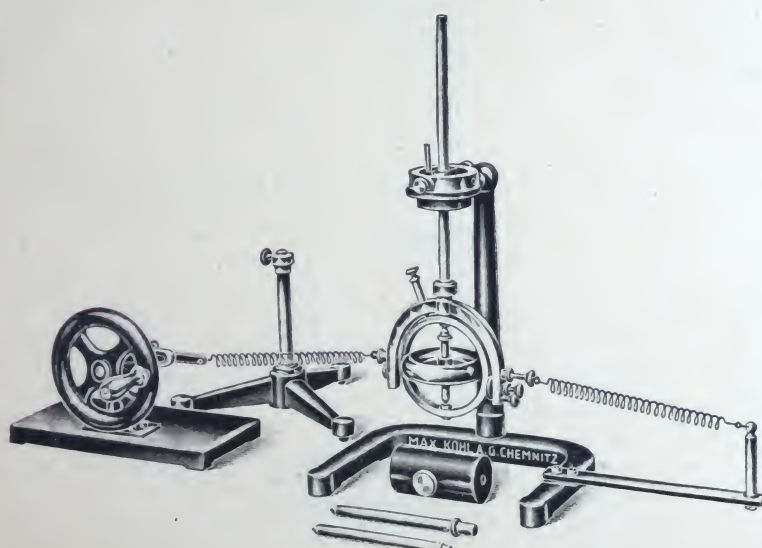
- | | |
|---|--------------------|
| 51946. Model (No. 15), Governor Model, Figure, for proving the surface law, specially suitable for demonstrating the increase of angular velocity with decreasing moment of inertia (Z. d. V. d. I., 1909, p. 1301 et seq., No. 15, Fig. 45 on text-sheet 16); Description | £ s. d.
9. 0. 0 |
| 52076. Model (No. 17), Apparatus for demonstrating the Surface Theorem (Hanging Frame with Electric Motor), Figure, for proving that a rotating mass imparts in an opposite direction an angular velocity in a co-axially rotary mass, this angular velocity corresponding to the ratio of the moment of inertia. With 110 volt D.C. motor (Ztschr. d. V. d. I. 53, 1909, pp. 1303 et seq., No. 17 and text-sheet 16, Fig. 48); Description | 8. 0. 0 |
| 52120. Model (No. 18), Spring Pendulum for explaining Oscillations, Figure, for demonstrating the individual periodicity of a system, the periodicity of a periodic force, the forced oscillations, the static deflection, resonance and the critical periodicity of a force (Z. d. V. d. I. 53, 1909, pp. 1301 et seq., No. 18 and text-sheet 16, Fig. 49); Description | 2. 5. 0 |
| 52142. Model (No. 19), Apparatus the demonstrating Torsional Vibrations of elastic Waves and the concomitant Phenomena of Resonance, Figure (Z. d. V. d. I. 53, 1909, pp. 1301 et seq., No. 19 and text-sheet 16, Fig. 50); Description | 6. 15. 0 |



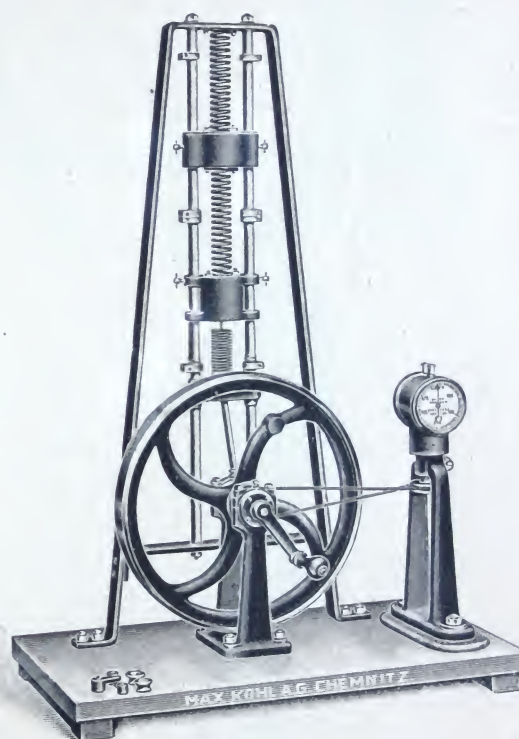
51834. 1:12.



82637. 1:11.



82638. 1:14.



82639. 1:12.

51834. **Model (No. 21) for the equalisation of rotating Masses**, Figure (Z. d. V. d. I. **53**, 1909, pp. 1301 et seq., No 21 and text-sheet 16, Figs. 56 and 57), for demonstrating the equalisation of locomotive driving axles and the discovery of errors in steam turbines and turbo-generators; **Description** £ s. d. 10. 0.0

82637. **Model (No. 24) for Demonstrating the Theory of the Gyroscope (and the Impulse Theorem)**, Figure 7. 10.0

The wire ring represents the circular centre line of a centrifugal ring which, as shown in the illustration, can be arranged so as to rotate about a horizontal diameter or placed in a ball bearing, being then capable of rotating in all directions. Four wood cylinders capable of movement on the wire ring represent mass-points of the gyroscope, and, with the aid of a number of long and short arrows, gyroscopic effects and the impulse theorem may be demonstrated.

82638. **Model (No. 25), Gyroscopic Apparatus for demonstrating the use of the gyroscope for technical purposes, especially in the Schlick Marine Gyroscope and the Scherl-Brennan Monorailway. Can also be used as a Precession Apparatus. Large Pattern. Figure. Description** 19. 0.0

82639. **Model (No. 26), Apparatus for demonstrating the Resonance of two coupled Masses. With Tachometer, Figure; Description** 21. 0.0

With this apparatus it is possible to demonstrate the oscillations that two elastically coupled masses undergo when a force, acting periodically in accordance with the sine law, is acting upon one of them.

Models as suggested by
Prof. Prandtl, Prof. Bach, Prof. Skutsch, Prof. Vater, Prof. Michel, Dipl.-Ing. Winkel.



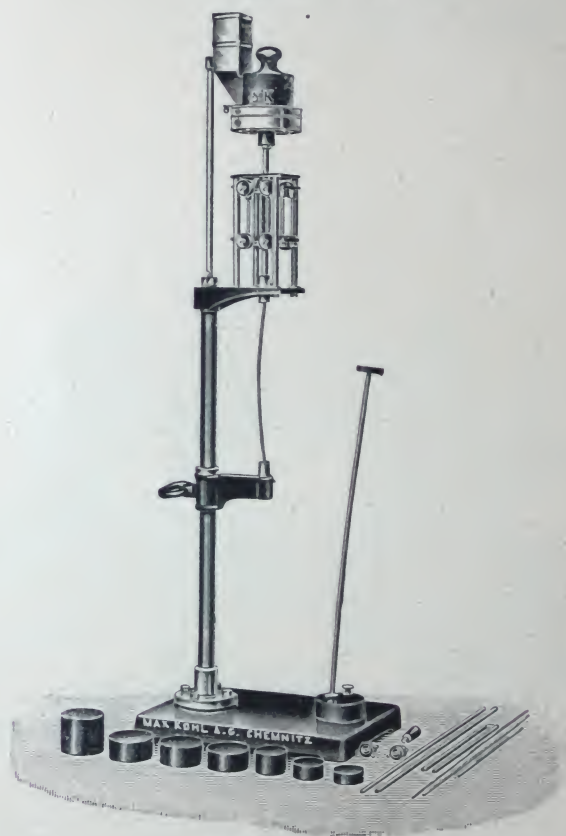
52075 A. 1:10.



52186. 1:14.



52075 B. 1:30.



52187. 1:13.

52075. **Rotating Disc and Weighted Bar**, as suggested by Prof. L. Prandtl, Figs. A and B, for showing the relations between Angular Velocity and Moment of Inertia (Ztschr. d. Vereins deutscher Ingenieure, 1909, pp. 1301 et seq., **No. 16** and Figs. 46 and 47 on text-page 16) £ s. d.

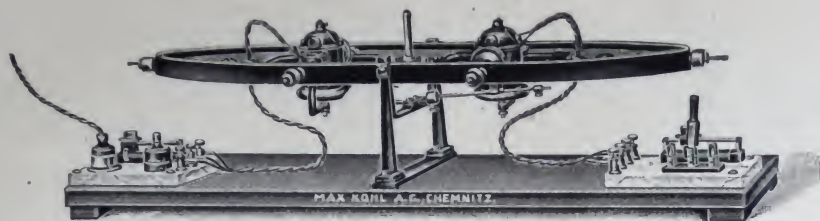
52186. **Breaking Model** (Bach's), Figure (Ztschr. d. V. d. I. **53**, 1909, pp. 1901 et seq., **No. 10** and text-sheet 14, Figs. 33 and 34), for showing that the resistance to breaking strain is inversely proportional to the square of the length of the bar 5. 10. 0

On loading the bars, which are gripped vertically, stable equilibrium occurs between the bending moment of the load and the elastic forces, either when the bars are in an extended or a curved position; — or — when the load is considerable — a condition of equilibrium does not take place and the wood bars are fractured. Test bars are given in with the apparatus, these comprising bars of various material in lengths of 30 and 60 cm.

52187. **Apparatus for Demonstrating Resistance to Breaking Strain of Bars**, as suggested by Prof. Michel, Figure 1. 15. 0

With this apparatus the resistance to breaking strain of bars of different lengths, varying section, and of different materials can be determined and the bars can be gripped either on one side, or both ends can be left free and be guided in the original axis or both ends can be gripped and guided in the original axis. Under otherwise equal conditions, the notch-loads behave as 1:4:16.

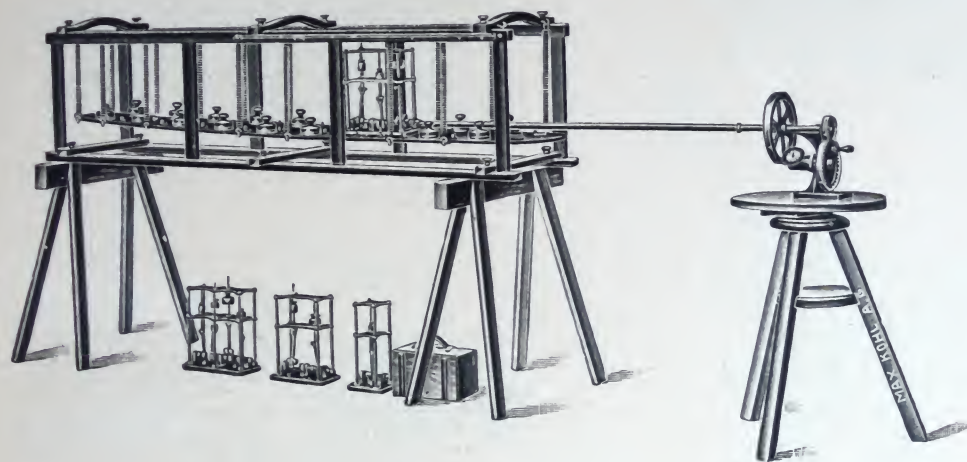
52187a. — idem, with automatic application of the load 10. 0. 0



52091. 1:11.



82640. 1:20.



52121. 1:30.

52091. **Model (No.22), Ship's Gyroscope** after Schlick; model after Skutsch (Ztschr. d.V. d. I. 52, 1908, p. 464), Figure, for connecting up to a 110 Volt Direct Current Supply £ d. s.
18. 0.0

An iron frame represents the hull of the ship, being suspended in a cardan joint so as to enable the hull to be moved in any direction. It carries two gyroscopes driven by small electric motors, these gyroscopes being mounted in special suspensions perpendicular to the ship's axis. The free motion of the gyroscope suspension in the direction of the ship's axis can be retarded by brakes. One of the motors, being fitted with a reversing switch, can rotate in either direction, so that the gyroscope can revolve in either direction at will. The model clearly demonstrates that, where only one gyroscope is used, the pitching or rolling of the boat is considerably damped down, but that a part of the pitching motion is converted into a stamping movement, and that the stamping movement is damped down and also partially converted into a disturbing pitch. It is only when the two gyroscopes are used in opposite directions that these additional movements disappear. The gyroscopes damp both movements very considerably.

52121. **Model (No. 20) for Demonstrating the Oscillation of Ships**, after Schlick. Figure, with trestles and small tables, with a double triple and quadruple crank engine model, the latter having the Schlick arrangement of crank (Z. d V. d. I. 53, 1909, pp. 1301 et seq., No. 20 and text-page 16, Fig. 51); **Description** 125. 0 0

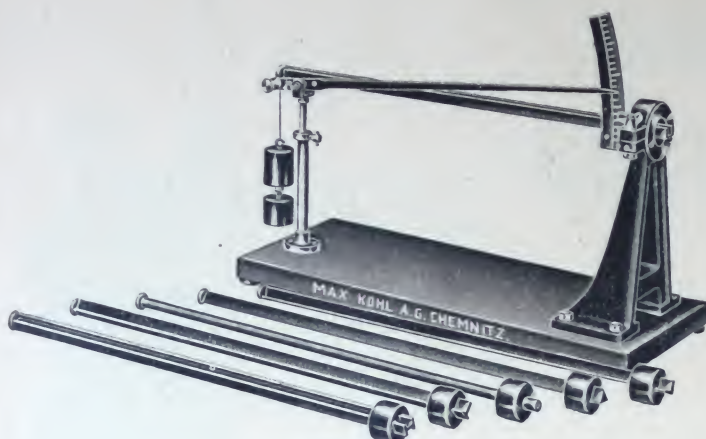
This model has been designed for showing, generally, **oscillation phenomena**, but especially the **compensating of marine engines**. A plank is suspended movably on spiral springs, and on it are placed models of marine engines with masses corresponding to those which set up the oscillations. These models are set into motion by means of a side drive arrangement, and the remainder of the plank is uniformly loaded with special loading weights. Vibrations of the first and second order are set up according to the point at which the engines are set up, and according to number of pistons used and the revolutions of the engines. Special marks on the plank and special directions given with each apparatus enable the critical points involved to be discovered.

82640. **Model (No. 27), Rotor Wheel** after Prandtl, **for Demonstrating Gyroscopic Action**, Figure, with centrifugal masses, 2 handles and cord pulley for winding up; without rotating disc 1.15.0

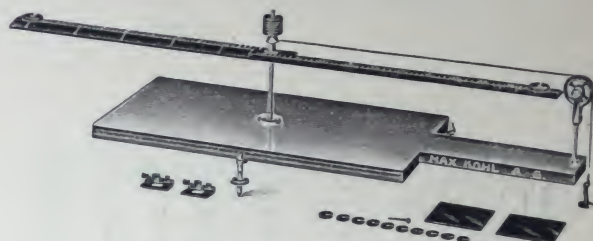
The rotor wheel is set into rapid rotation and the held upwards or downwards or sideways, the gyroscopic action according to each position being set up, the revolving stand and the turning of the demonstrator assisting the effect.

52075. **Rotating Disc and Weighted Bar**, as suggested by Prof. Prandtl (Figure on page 1410) for proving the surface law 5.10.0

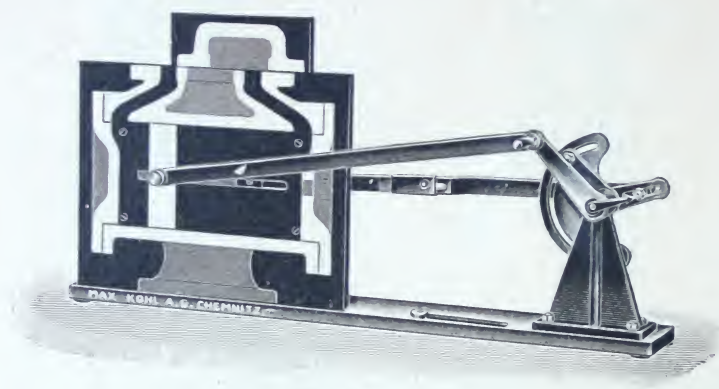
82635. **Model (No. 28) of Band Brake** after Vater (Figure on page 1404) 12.10.0



82641. 1:12.



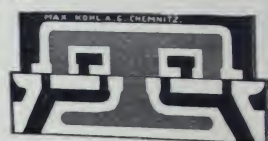
82642. 1:12.



55264A. 1:16.



55264B. 1:16.



55264C. 1:16.

82641. **Model (No. 29) for Tests on the Moment of Inertia**, after Vater, Figure (See: Dingers Polyt. Journal, Vol. 330, Nos. 24/25)

£ d. s.
17. 10. 0

It is possible to demonstrate with this apparatus how the distribution of the masses in rods of uniform cross-sectional area but different profile affects the moment of inertia. It is also possible to show how, with the same profile, the moment of inertia changes by rotating the axes. Eight test rods of the same material but of different cross-section are supplied with the apparatus. With the same load the sag of the rods, fixed at one end, is inversely proportional to the moment of inertia. The sag or deflection is magnified by a system of levers, so that the varying magnitude of the moments of inertia can be read off directly on a scale.

82642. **Model for Demonstrating the Theorem of the Moment of Inertia and the Radius of Inertia**, after Koppe, Figure (Ztschr.f.phys.u.chem. U. 5, 1891, p. 10; Fr. phys. Techn. I. 2, Fig. 3270)

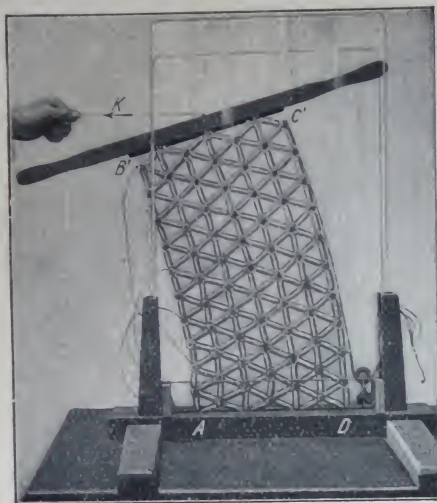
2. 0. 0

A wood straight-edge, about 1 metre in length, has a round hole in the middle fitting into a hollow wood cylinder having a steel cap let into it. By means of this cap, the straight-edge can swing like a compass needle upon a steel point, the top surface of the straight-edge being bevelled on both sides to decrease air-resistance. At the middle of the wood cylinder the straight-edge is fitted with a few flat lead rings which can be easily detached and placed on the straight-edge, graduated in centimetres, and at a measurable distance from the centre. A cord is wound several times round the top of the wood cylinder, this cord leading horizontally to a pulley, capable of rotation, while on the free portion of the thread, hanging vertically, is a ring in which weights of from 1 to 10 grams can be suspended.

55264. **Sectional Model of Steam Engine Cylinder**, after Prof. Vater, Fig. A, B and C, large plainly understandable model, with adjustable advance and eccentricity, with interchangeable cylinder and valve parts for the ordinary three-port slide valve, Fig. A, the double-inlet channel slide-valve, Fig. B, and the Penn slide valve with double port for inlet and exhaust, Fig. C, painted in clear colours

15. 0. 0

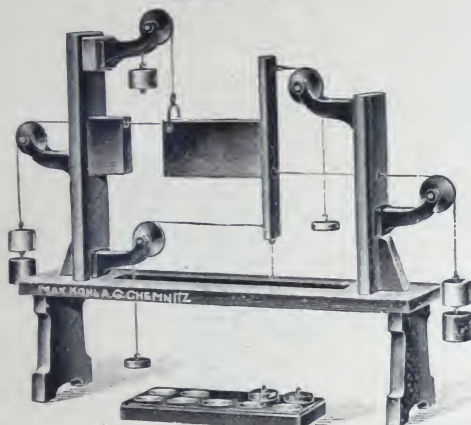
This model enables the method of working of the various slide-valves in steam engines to be demonstrated at different angles of lead and varying eccentricity. It is also possible to show the **Reversing** of the steam engine by varying the angle of advance, and the **correct adjustment** of slide valves that are working wrongly. The dimensions and get-up of the model are such that that the various processes can easily be seen by a large audience.



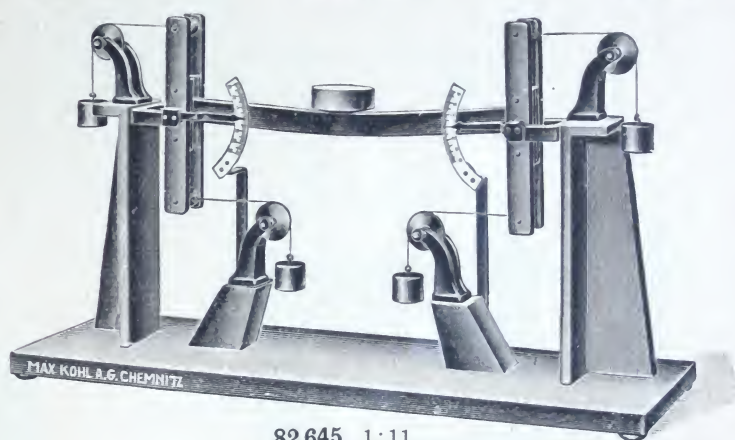
52189. 1:12.



82643. 1:13.



82644. 1:12.



82645. 1:11.

52189. **Apparatus** (Prandtl's), for Demonstrating the Angular Changes at the edges of a body by shearing stresses occurring in pairs (Ztschr. d. V. d. I. 53, 1909, pp. 1301 et seq., No. 12, Figs. 36 and 37, and text-sheet 14, Figs. 38 and 39), Figure

The apparatus consists of a system of spiral springs arranged between two glass discs as in the illustration. If these are pulled as shown in the illustration no angular changes result at the corners A, B', C' and D; this case corresponds to ordinary bending. Shearing forces can be applied at the same time; in this case angular changes also take place at the corners, i. e., the right angles are sometimes acute and sometimes obtuse.

82643. **Model (No. 32), Reinforced Girder**, after Ensslin, Figure (See: Tochtermann, Ztschr. f. d. gewerbl. Unt., Vol. 28, 1913, p. 341)

Reinforcement, the effects of which are very well demonstrated by this model, is represented by thin steel wire, this wire being kept slack so that no stressing occurs in the system at the outset. If the reinforced beam is placed horizontally and then loaded with one of the weights, no flexure, or practically none, is noticeable. The fact is also demonstrated that only two diagonals are required for stiffening the beam, the other two remaining unstressed (the wire slack). A non reinforced beam model is also supplied, and this is set up in the same way as the reinforced beam, to show the marked flexure that occurs. A special support is supplied enabling both the reinforced and the plain beam to be set up obliquely like a fire-escape, with a view to showing again the effect of reinforcing when the beam is stressed.

82644. **Model (No. 33) of a Beam fixed at one End**, after Ensslin, Figure (See: Tochtermann, Ztschr. f. d. gewerbl. Unt., Vol. 28, 1913, p. 341)

This model demonstrates the equilibrium of external and internal stresses in systems. The beam is cut through, and to the portion cut off are first of all applied the forces that are necessary to establish the original equilibrium. If the end of the bar is loaded, it is at once evident that **bending and shearing effects** have been set up by the external force, and that the bending at the cross-section of the beam sets up effects that are partly tensile and partly compression effects. The magnitudes of the forces in play can also be measured. The illustration shows the combination with which it can be demonstrated that when the beam-end is loaded by an external couple in the cross-sectional area under consideration, only tensile and compressive stresses are set up, which are equal to each other, and that no shearing effect is present.

82645. **Model (No. 34) of a doubly supported statically indeterminate Beam**, after Ensslin, Figure (Tochtermann, Ztschr. f. d. gewerbl. Unt., Vol. 28, 1913, p. 342)

This model serves to demonstrate that "fixing" in the sense intended by the strength of materials, is tantamount to a free bearing, but that where the beam bears, a couple of forces is present, viz., the so-called moment at the fixed end. This moment can be determined in the model by levelling, so that the beam supported at both ends has been statically determined. Further, the model enables the **superposition law** of the bending angle to be recognised and demonstrated. The beam is a rubber bar whose ends bear freely, or are secured by applying a couple. The alterations in angle can be read off on pointers and scales.

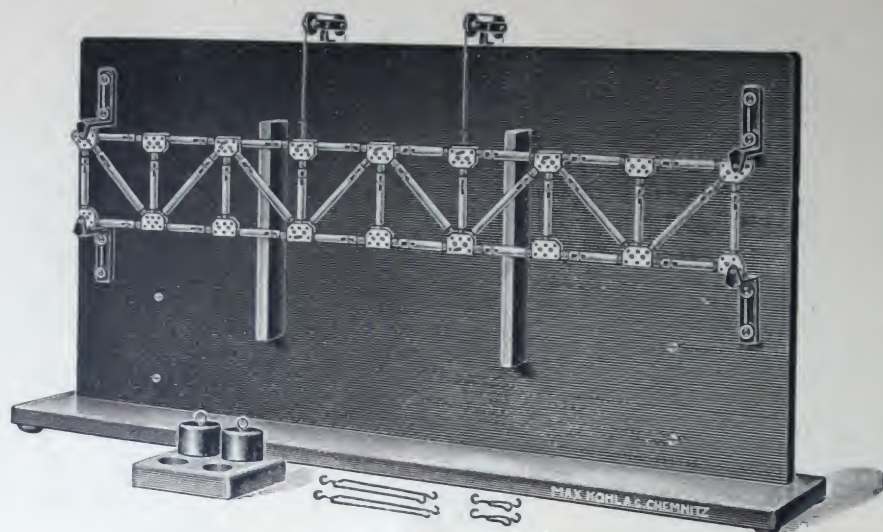
£ s. d.

1. 15. 0

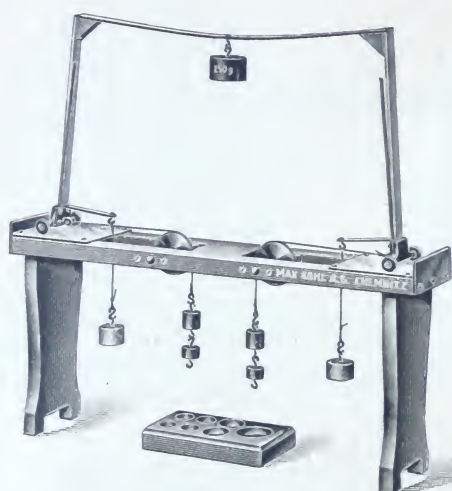
3. 10. 0

4. 0. 0

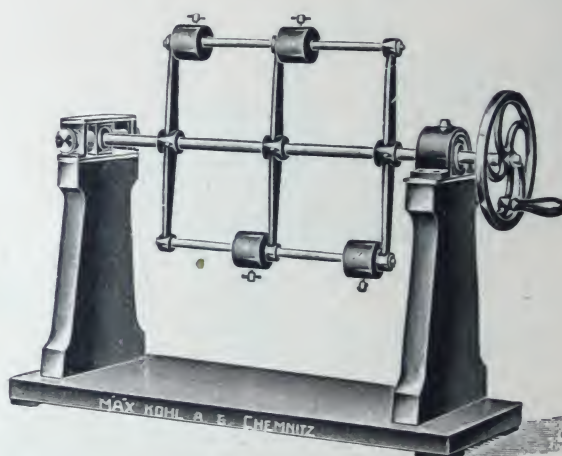
6. 0. 0



82646. 1:8.



82647. 1:10.



82648. 1:12.

82646. **Model (No. 35) of a Lattice Girder (Parallel Girder)** after Ensslin, Figure (Tochtermann, Ztschr. f. d. gewerbl. Unt., Vol. 28, 1913, p. 325)

£ s. d.
14. 10. 0

The several rods are arranged as **spring balances**, which show both the magnitude of the tensile stresses occurring and the extent of the compressive stresses.

The model also serves to demonstrate that, with a purely system-point loading the various bars of the lattice are only stressed by forces at their axes, i. e., that a force acting on any knot is propagated by all the bars up to their points of support without setting up bending stresses in any of the bars.

The model can be built up in different forms. (1) as a parallel girder with **diagonal ties in tension**, (2) with **diagonals in compression**, and (3) with a linking up of the intermediate bars on the **V-system**. In each of the three cases, the load can be allowed to shift from one point of the system to the other and the forces acting in the several bars thus explained. In this way, the special properties of the systems and their suitability or otherwise for a given purpose are ascertained. By applying a load simultaneously to two or three adjacent centres the method of loading obtaining in all bridge and travelling crane girders due to the load shifting, can be demonstrated. In addition to being arranged to take the load on the top boom, the model is suitable for taking the load on the lower boom. The phenomenon of the unstressed bars in the lattice-work can also be perceived.

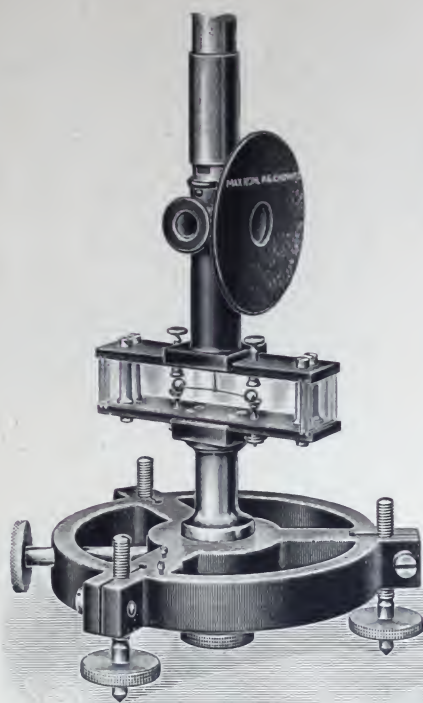
82647. **Model (No. 36) of a Gantry Crane Girder** after Ensslin, Figure (Tochtermann, Ztschr. f. d. gewerbl. Unt., Vol. 28, 1913, p. 343)

4. 0. 0

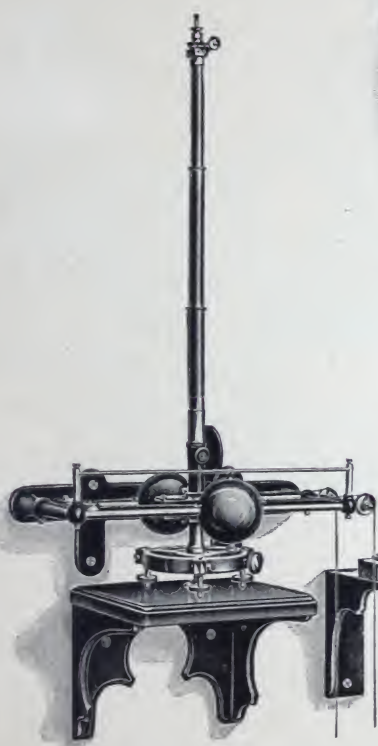
The model is constructed of flexible wood. Owing to the corner bracing, the upper bar may be regarded as a fixed beam; the ends of the feet are fitted with small castors which can be conveniently moved to and fro along glass slabs. At the feet is an arrangement for securing them in position and clamping them. The various deformations that take place when a load is applied can be clearly demonstrated for the case in which the **feet** of the scaffolding or frame are **entirely free** to move and so **secured against displacement** (but not fixed), and finally where they are **completely fixed** at the point of fixation. The extent of the **shearing stresses** coming on to the feet can be accurately determined on the model by a levelling operation, as well as the moment at the fixed end. Further, the **superposition law** of bending can be demonstrated by loading the framework and then removing the load.

82648. **Model for Compensation of Masses** after Prof. Meyer (cf. No. 51834, Model No. 21), altered as suggested by Dipl.-Ing. Winkel, Figure

10. 0. 0



52144C. 1:2.5.



52144A. 1:9.



52144B. 1:5.

52144. **Apparatus for Cavendish's Experiment on the Attraction of Mass** (Gravitation Balance),
as suggested by Boys, Figs. A, B and C (Ztschr. f. d. phys. u. chem. U. **14**, 1901, p. 381
— M. T., p. 86 — Ebert, Lehrbuch der Physik, Tome 1, 1912, p. 223) £ s. d.
15. 0. 0

Two small silver balls, each 0.75 g in weight, are suspended by means of a very fine quartz fibre from a fine balance beam (torsion balance). The whole is enclosed in a glass case and has a very good arrestment device so that the instrument can be carried about from one place to another without fear of damage. The small balls are influenced by large lead balls each 2800 grams in weight which can be moved along a frame to the two end positions by cords. In order to make the deflections visible to a large audience, an image of the filament of a glow lamp is produced on a scale fixed to the wall by the aid of a bi-convex lens and a light mirror fixed on the apparatus.

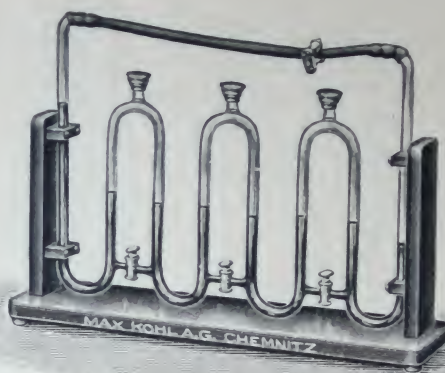
To give an idea of the sensitiveness of the apparatus, we may mention that an apparatus installed in our test room gave a preliminary deflection of $\frac{1}{8}$ of the scale distance in one direction when the lead balls were moved from the centre to one of the end positions; after some movement to and fro of the balls the luminous pointer stopped at about 21 cm to the left or right according to the direction of movement of the balls. The scale distance in this case was only 2.25 m. — Complete directions for use are given with each apparatus.



52440. 1:10.



52442. 1:6.



52456. 1:9.



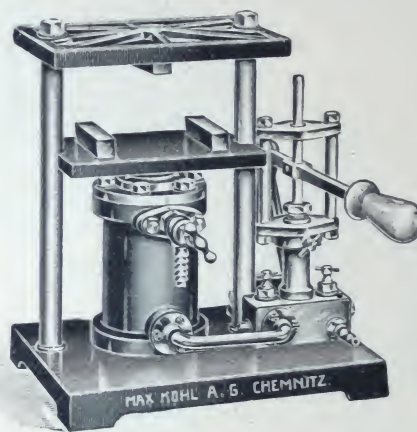
52509. 1:2.



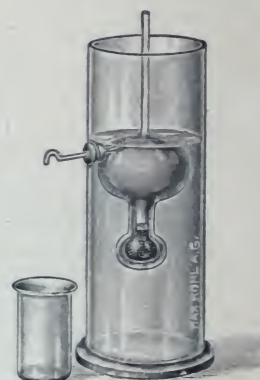
52478. 1:8.



52502. 1:6.



52463. 1:8.



52513. 1:8.

Equilibrium, Motion and Molecular Effects of Liquids.

Equilibrium of Liquids.

52440. **Tube Level Model** (Weinhold's), Figure (W. D., Figs. 104 and 105 [93 and 94]), length 40 cm, with polished stand £ s d.
0. 11. 0
52442. **Tube Level** with metal base, Figure (W. and E. phys. Prakt., Fig. 12) 0. 7. 0
52456. **Wave Tube** (Maxwell's), Figure, for explaining the **formation of the residuum, slow equalisation of pressure**; can be used as an **analogue for the charge and discharge of a condenser** (Fr. phys. Techn. I, 2, Fig. 2392); **Description** 2. 10. 0
52463. **Hydraulic Press**, of metal, for a pressure of 1500 kg, Figure; **Description** 8. 10. 0
52478. **Apparatus for proving Pascal's Law**, after Friedr. C. G. Müller, Figure (M. T., Fig. 62 and 119), to be used as an analogon of the **Ordinary Barometer** and of the **Siphon Barometer** 0. 8. 0
- The following are immersed in an upright cylinder filled with water: (1) 1 barometer tube open at both ends, this being placed under the water in a dish containing mercury; and (2) 1 unequal-limb hooked tube, which has to be filled with mercury.
52502. **Model of the Channel Balance**, after Friedr. C. G. Müller (M. T., Fig. 60) Figure 0. 8. 0
- The rings mark the water level when both limbs are on the same horizontal support. By lowering one limb the meniscus in it drops to half the difference in level, while in the other limb it rises to the same extent. (Law of communicating tubes)
52509. **Solid and Hollow Cylinders** for explaining the Archimedian Principle, Figure (M. P. I., Figs. 375, 376 [373, 374]) 0. 10. 0
52513. **Float Apparatus**, after Schellen, Figure, for showing that a floating body becomes immersed in the liquid until the volume of liquid displaced by it becomes equivalent to its own weight (explanation of the hydrometer); **Description** 0. 15. 0



52529. 1:4.



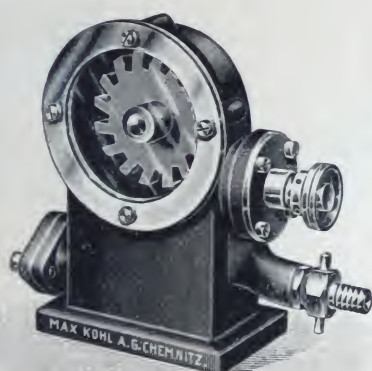
52610. 1:16.



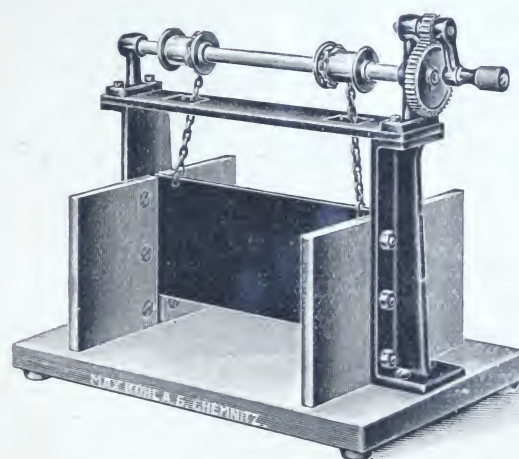
52561. 1:10.



52589. 1:8.



82649a. 1:6.



52646. 1:7.

52529. **Small Flask and Watch Glass** (after Al Birûni), for determining the Specific Gravity of Solids by the displacement method, Figure (W. u E. phys. Prak., Fig. 26. — Fr. phys. Techn. I, 2, Fig. 2303) £ s. d.
0. 2. 0

The volume of the solid is determined by weighing the quantity of liquid displaced by it from the flask.

52561. **Pneumatic Densimeter**, for determining the Specific Gravity of Liquids, after Boyle, Figure 1. 8. 0

The apparatus consists of double tube with scale, rubber tubing and pinch-cock, 2 glass dishes and stand on levelling base.

Motion of Liquids.

52589. **Apparatus** after Colladon for showing the parabolic form of the outflowing Water Jet; can be used at same time for demonstrating total reflection in a water jet (W. D., Fig. 291 [274]). Figure 0. 16. 0

52610. **Apparatus for Decrease in Pressure** after Friedr. C. G. Müller, Figure (M. T., Fig. 73) 0. 10. 0

The illustration shows the apparatus in the state of equilibrium. The water is brought by suction in a flask at the top and is left. The level in the three tubes is such that a straight line can be drawn from the level of the water in one of the flasks to the water-level in the other.

82649. **Water Motor** for connecting up to the Water Supply. This motor can be used for driving high-speed machines like fans, dynamos, etc., or, with suitable gearing, for slow-running machines. **Without** glass plate, closed in with iron plate 5. 0. 0

- 82649a. — idem, Figure, with glass plate 6. 0. 0

52646. **Model of an Apparatus for raising the Sluices, with Switch-gear and with Chain-pull**, Figure 7. 10. 0

Cl. 6953, 6751, 6892,
6727,
6128, 6916



52675. 1:8.



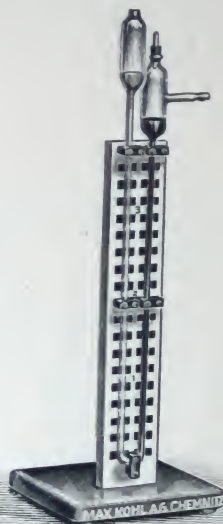
52696. 1:5.



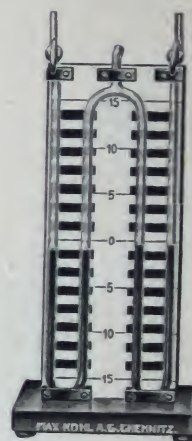
52731. 1:8.



51244a-51249a. 1:10.



52737. 1:10.



52738. 1:10.

Molecular Effects of Liquids.

52675. **Dropping Apparatus**, after Friedr. C. G. Müller, Figure, for showing Surface Tension (M. T., Fig. 78), suitable for the Projection Lantern £ s. d.
 0. 6. 0
 The liquid used for dropping is coloured colza oil in a mixture of water and alcohol, of such density that the drops fall slowly.
52696. **Apparatus** after Jamin, for demonstrating the absorption of liquids through porous bodies (Chwolson, Lehrb. d. Phys., I, Fig. 328), Figure 0. 10. 0
 A cube of chalk contains a cavity for taking a manometer, the cube being immersed in water.

Equilibrium, Motion and Molecular Effects of Gases.

Equilibrium of Gases.

Calibrated Bell Glasses for measuring the volume of gases (M. T., Fig. 5), with clamping ring, without glass receiving cylinders, Figure. £ s. d.

List No.	51244a	51245a	51246a	51247a	51248a	51249a
Capacity ccm	100	250	500	1000	1500	2000
Size about mm	220×30	280×40	360×55	450×65	470×75	500×80
Price, each: £	0. 7. 0	0. 8. 0	0. 9. 6	0. 12. 0	0. 14. 0	0. 16. 0

Glass Receiving Cylinder: List No. 51244b 51245b 51246b 51247b 51248b 51249b
 Price, each: £ 0. 0. 10 0. 1. 0 0. 1. 10 0. 3. 6 0. 5. 0 0. 8. 0

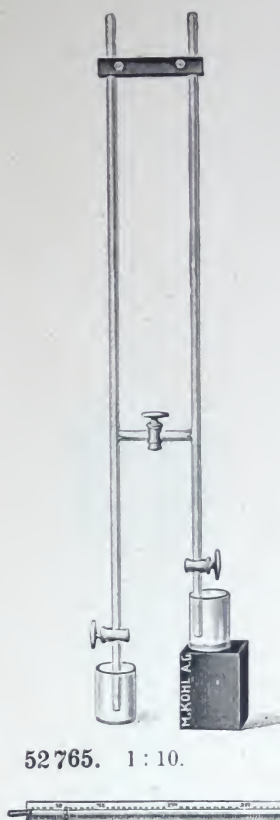
52731. **Pressure Level** after Friedr. C. G. Müller, (M. T., Fig. 67), Figure with U-shaped horizontal tube, with 2-colour centimetre graduation 0. 18. 0
52737. **Sensitive Syphon Pressure Gauge**, after Grimsehl, Figure, based on the difference in the specific gravity of two liquids (Ztschr. f. d. phys. u. chem. U. 18, 1905, p. 199, Fig. 1) 0. 18. 0
25738. **Duplex Pressure Gauge**, after Friedr. C. G. Müller, Figure (M. T., Fig. 66), a syphon pressure gauge for two liquids, for different ranges; can be used aerostatically and hydrostatically 0. 16. 0



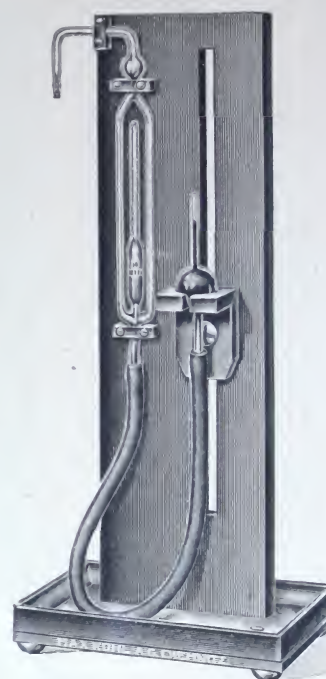
52748. 1:12.



82650. 1:9.



52765. 1:10.



82651. 1:7.



82652. 1:10.

52748. **Barometrical Pressure Gauge (Differential Barometer)**, after Regnault-Leduc, Figure, consisting of a mercury barometer and a pressure gauge having common vessel, suitable for readings with the cathetometer (Gan.-Man., Fig. 158) £ s. d.
8. 0. 0

82650. **Apparatus for carrying out the Torricellian Experiment**, after Prof. Dropiowsky, Figure 1. 0. 0

In this piece of apparatus, the funnel, mercury cistern and barometer tube form a whole, the operation of filling and emptying out the mercury being facilitated and the mercury prevented from getting dirty or shaken up. The glass vessel is graduated, to correspond with the lower end of the barometer tube, from 0 to 20 mm. the graduation is continued on the glass tube from 600—800 mm. while the tube itself is ungraduated from 20—600 mm.

52765. **Duplex Barometer**, after Kleiber, Figure, with two tubes connected under the mercury level (Er. phys. Techn. I, 2, Fig. 2560; Ztschr. f. d. phys. u. chem. U. 14, 1901, p. 247, Fig. 2) 0. 12. 0

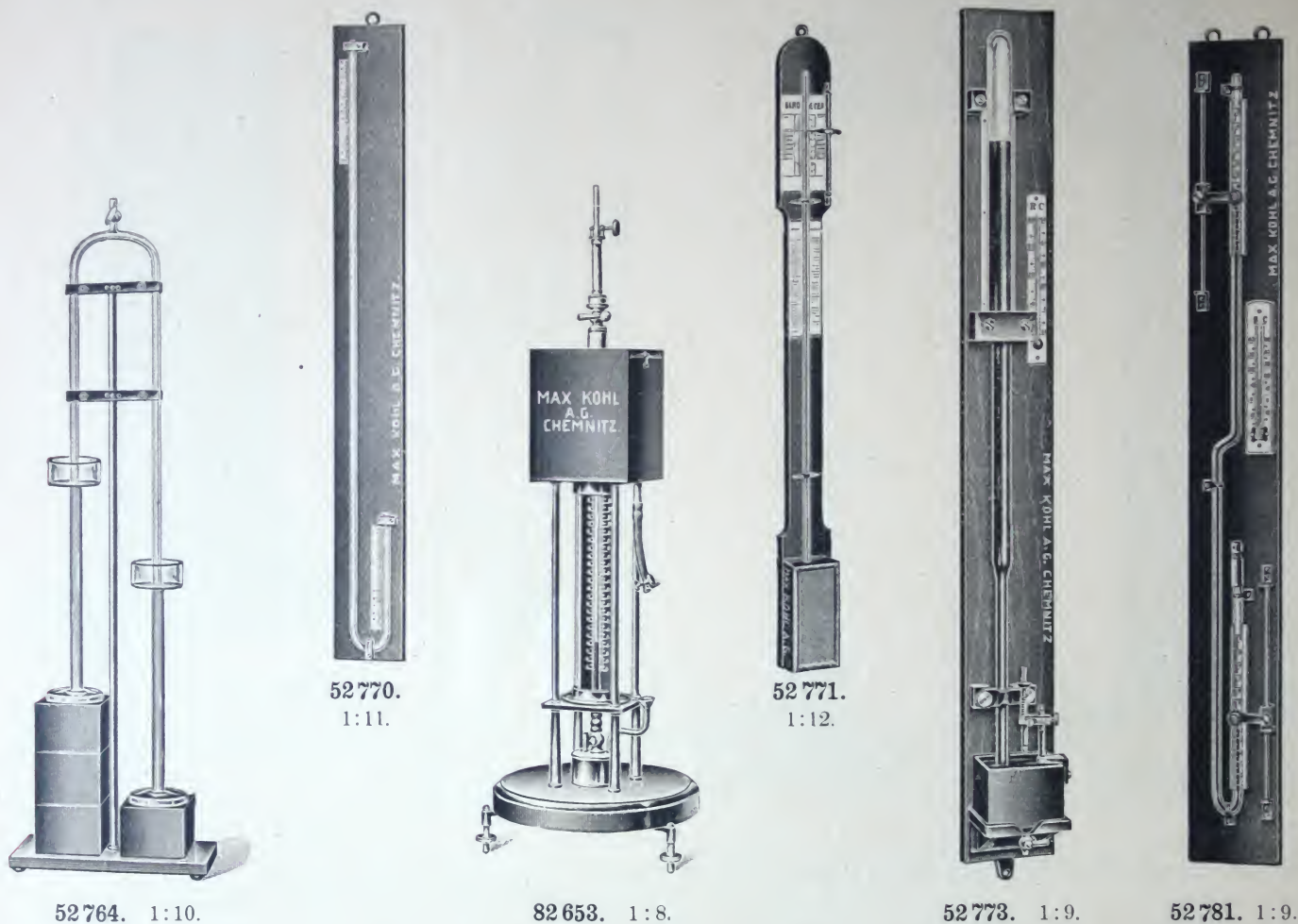
82651. **Shortened Vacuum Gauge** (MacLeod's), Figure, without Mercury 3. 0. 0

The apparatus enables pressures of below 3 mm. of mercury to be measured. The operation of the instrument is based on an application of Mariotte's law stating that rarified air compressed to the n -th part of its original volume exerts n -times the pressure.

The cylindrical vessel and the capillary tube above it has, including the capillary, a volume of 10 c. c. By raising the bulb filled with mercury, a portion of the already rarified air is shut off in the cylindrical vessel and compressed to a volume of, say, 0.05 c. c., i. e., to the 200th part of its original volume. If now the difference in level of mercury between the right hand tube and the capillary is, say, 5 mm., then the pressure is actually $5:200 = 1/40$ mm mercury column.

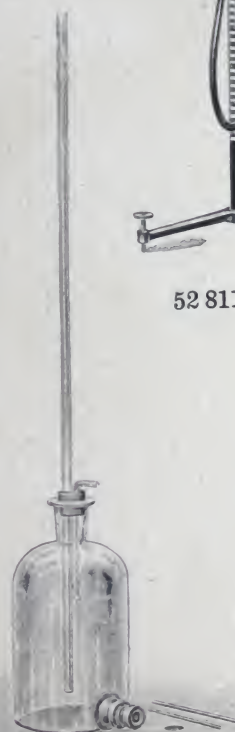
82652. **Capillary Barometer** after Melde, Figure (Ztschr. f. d. phys. u. chem. U., 1902, p. 196) for proving the Boyle-Mariotte Law 0. 3. 0

In the capillary tube, closed at one end, is a mercury thread 20—30 mm long, which forms a hermetical seal for the enclosed air. The thread can easily be displaced along the tube. By turning the tube so that it is first of all vertical with the open end upwards, then horizontal and finally vertical with the open end underneath, the air enclosed in it is reduced to the pressures $b+h$, b , $b-h$, where b is the barometric height, h the length of the mercury thread in the tube. Assuming the tube to have a uniform cross-section, the volume of air is proportional to the length l of the enclosed column of air. If the Boyle-Mariotte law is correct then the product of the pressure p and the length l must be constant.

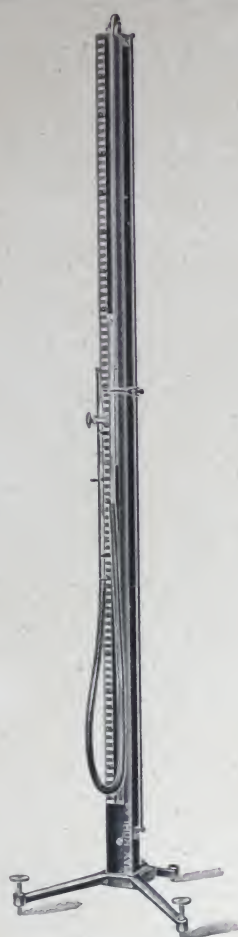


- | | |
|---|---------------------|
| 52764. Duplex Barometer with two vessels, Figure, for two liquids (Fr phys. Techn. I, 2, Fig. 2559, see also Ztschr. f. d. phys. u. chem. U. 14, 1901, p. 347) | £ s. d.
1. 10. 0 |
| 52770. Simple School Model of Syphon Barometer, Figure, with U-tube (Kleiber, Lehrb. f. Gymn., Fig. 115a), without mercury | 0. 12. 0 |
| 52771. Barometer, Figure, simple, on board with opal glass scale | 0. 12. 0 |
| 52773. Standard Barometer, after Regnault, Figure (Gan.-Man., Fig. 141), for reading with the cathetometer, with tube 2.5 cm wide and iron cistern without mercury | 8. 0. 0 |
| 52781. Syphon Barometer, with etched graduations on the limbs, with 2 adjustable sight vanes. Figure | 1. 10. 0 |
| 82653. Levelling Barometer, after August, Figure, for showing slight differences of altitude by measuring the alteration of air-pressure | 6. 0. 0 |

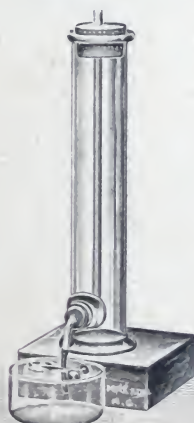
In the top wood case is a sheet iron vessel, and in this a glass bulb whose volume compared with that of the manometer tube is so great that no appreciable difference in pressure is set up through the alteration of the water level in the barometer-tube. In order to maintain a constant temperature of 0° C in the glass bulb during the measurement, the sheet iron vessel is filled with small pieces of ice, while a drain tube at the base carries off the water from the melting ice. By means of an air pump fixed above the box, the water, coloured with sulphurous ammonium copper oxide, is raised from the lower cylindrical vessel, connected by a rubber tube and a cock with the barometer tube and through a second small tube and funnel with the atmosphere. This pumping action raises the water to the zero point after the temperature in the glass balloon has become constant. The measurement can then be carried out by carrying the apparatus from floor to floor and reading off the changes in air-pressure, these changes being perceptible as the observer ascends.



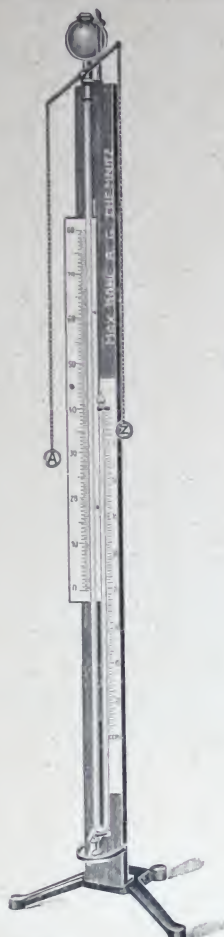
52835. 1:10.



52811. 1:19.



82656. 1:8.



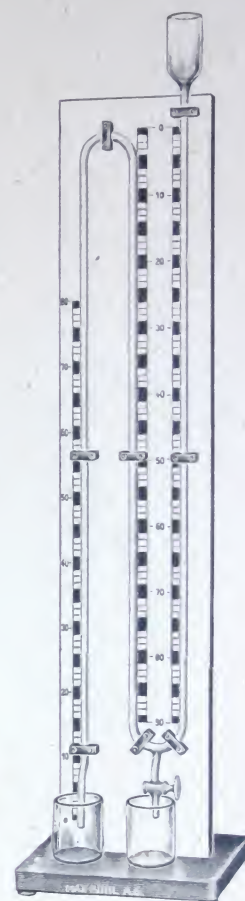
82654. 1:15.



82655. 1:13.



52870. 1:10.



52848. 1:12.



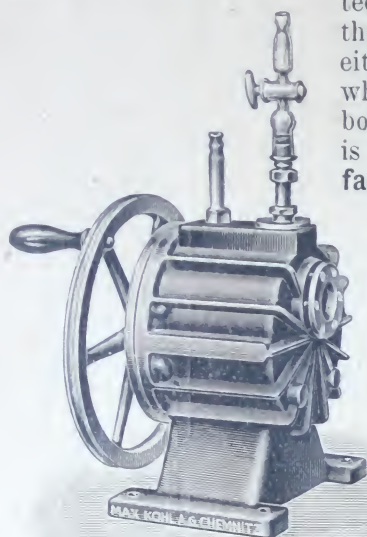
52876. 1:8.

- | | |
|---|--------------------|
| 52811. Boyle's Law Apparatus, Figure, after Feilitzsch, as altered by Weinhold (W.D., Fig. 139 [127]), 2.2 m, high, Description | £ s. d.
3. 12 0 |
| 82654. Mariotte's Law Apparatus, after Lohmann, Figure (Ztschr.f.d. phys. u. chem. U., 26, 1913, p. 334) | 4. 0 0 |
| The mercury required for filling the glass tube is contained in the bulb. By means of a pullcock A—Z it is admitted to the tube. The scale at A is of the sliding type, and on it are read the pressures and partial vacua. The apparatus can also be used for demonstrating the mercury barometer. | |
| 82655. Mariotte's, Law Apparatus after Friedr. C. G. Müller, Figure, modified form after Dr. Ecknig, Description | 2. 8 0 |
| 52835. Mariotte's Bottle after Friedr. C. G. Müller (M. T. Fig. 72), Figure, for outflow experiments under constant, adjustable pressures | 0. 12 0 |
| 82656. Mariotte's Bottle, Figure, with tube clamp (pinchcock), supporting block and catch-glass (H. Sch., Fig. 118) | 0. 8 0 |
| 52848. Syphon Apparatus, after Schulze (Fr. phys. Techn. I, 2, Fig. 2561), Figure | 2. 0 0 |
| 52870. Model of a Suction Pump, of glass, with metal stand, Figure | 0. 12 0 |
| 52876. Model of a Force Pump, of glass, with metal stand, Figure | 0. 12 0 |

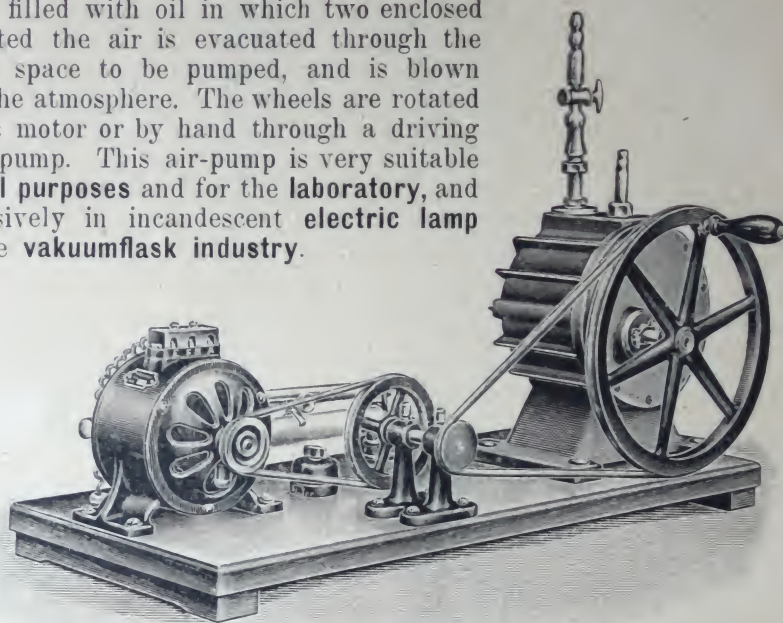
Rotary Oil Air-Pumps and Blowers.

Rotary Oil Air-Pumps (Enclosed Type).

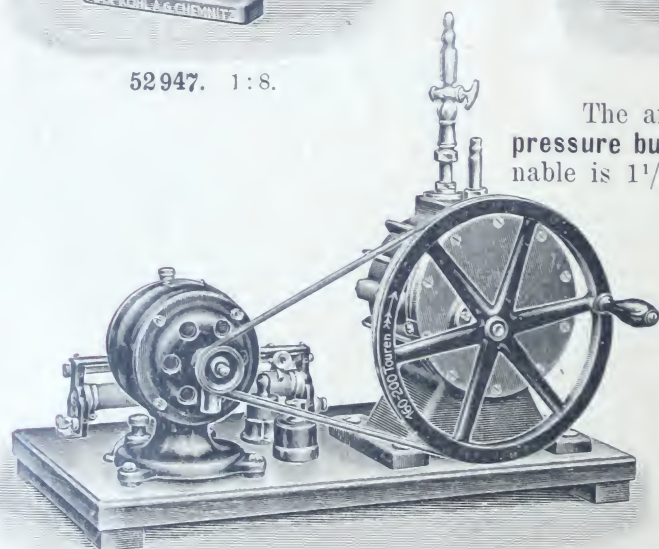
The air-pump consists of a casing partly filled with oil in which two enclosed gear wheels run. When the wheels are rotated the air is evacuated through the teeth gaps from the space to be pumped, and is blown through the oil into the atmosphere. The wheels are rotated either by an electric motor or by hand through a driving wheel fitted to the pump. This air-pump is very suitable both for **educational purposes** and for the **laboratory**, and is also used extensively in incandescent **electric lamp factories** and in the **vakuumflask industry**.



52947. 1:8.



63758. 1:10.



52950. 1:10.

The air pump can also be used a **Blower**, e. g., for operating **pressure burners**, and for **acoustical purposes**. The pressure attainable is $1\frac{1}{2}$ atmosphere for **Size 1**, 2 atmospheres for **Size 2**, and $2\frac{1}{2}$ atmospheres for **Sizes 3 and 4**. The special advantages of this air-pump are its simple design, compact form, high efficiency in short space of time, small amount of attention required, and small amount of space taken up.

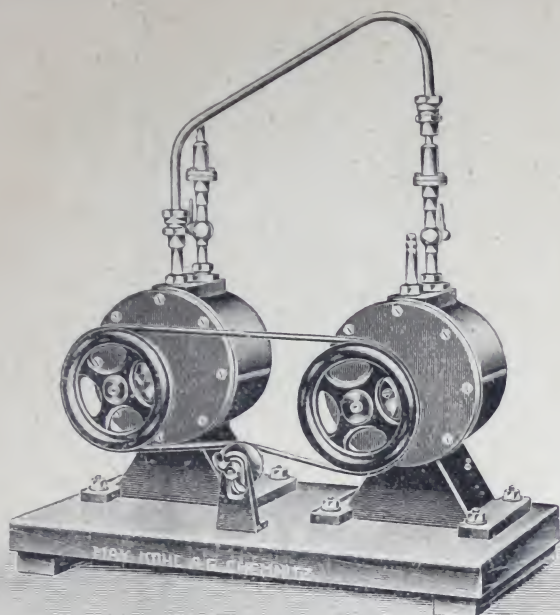
Outputs.

Quantity of Air exhausted with free passage:									
		Size 1		Size 2		Size 3		Size 4	
in 1 Minute		8 Litres		14 Litres		20 Litres		38 Litres	
in 1 Hour		480 "		840 "		1200 "		2280 "	
vacua attained in a Space of:									
		$\frac{1}{2}$ l	5 l	$\frac{1}{2}$ l	5 l	$\frac{1}{2}$ l	5 l	$\frac{1}{2}$ l	5 l Vol.
after 1 Minute		2.4 mm	75 mm	1 mm	38 mm	0.8 mm	23 mm	0.5 mm	5 mm
" 2 Minutes		1.8 "	28 "	0.6 "	6 "	0.5 "	5 "	0.3 "	0.9 "
" 3 "		1.6 "	14 "	0.4 "	1.6 "	0.4 "	1.6 "	0.3 "	0.6 "
" 4 "		1.4 "	5 "	0.4 "	0.8 "	0.4 "	0.6 "	0.3 "	0.4 "

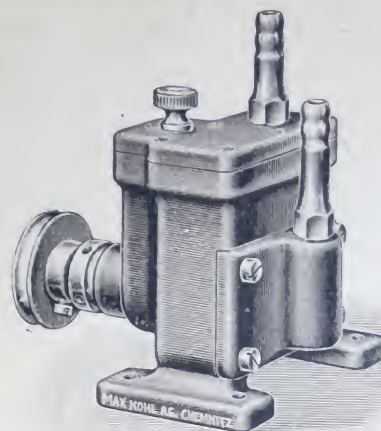
Size		1	2	3	4
Power required, about HP		$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{6}$
at Revs per minute		200-130	200-130	200-130	200-130
For Hand and Belt Drive, Figure	{ List No.	52945	52946	52947	63764
	{ Price £	8.0.0	9.0.0	10.0.0	12.0.0
With 110 Volt D. C. Motor, on board, with driving cord, switch, rheostat, plug box and plug, Figure	{ List No.	52948	52949	52950	63765
	{ Price £	14.0.0	15.0.0	16.0.0	19.0.0
With 220 Volt D. C. Motor, accessories as above	{ List No.	52951	52952	52953	63766
	{ Price £	14.10.0	15.10.0	16.10.0	19.10.0
With Three-Phase Motor, 110-125 V., accessories as above	{ List No.	63752	63756	63760	63767
	{ Price £	15.0.0	16.0.0	17.0.0	20.0.0
With Three-Phase Motor, 220 V., accessories as above	{ List No.	63753	63757	63761	63768
	{ Price £	15.10.0	16.10.0	17.10.0	20.10.0
With Alternating Current Motor, 110-125 V., accessories as above. Figure	{ List No.	63754	63758	63762	63769
	{ Price £	15.10.0	16.10.0	17.10.0	20.10.0
With Alternating Current Motor, 220 V., accessories as above	{ List No.	63755	63759	63763	63770
	{ Price £	16.0.0	17.0.0	18.0.0	21.0.0

When the air-pumps are to be used as **compressors**, this should be specially mentioned when ordering. The non-return valve and the stopcock in this case are of metal instead of glass, the **extra price** being 10 s. 0d.

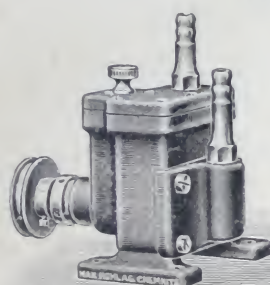
The power required when using the pumps as compressors is $1\frac{1}{2}$ — $2\frac{1}{2}$ times as great.



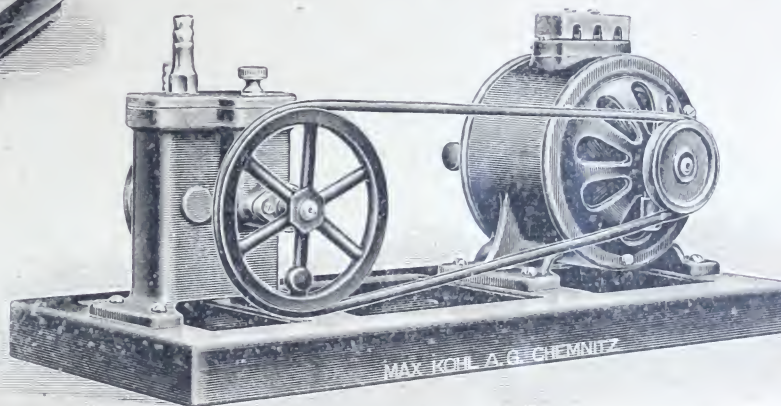
82 657. 1:12.



82 659. 1:3.



82 658. 1:3.



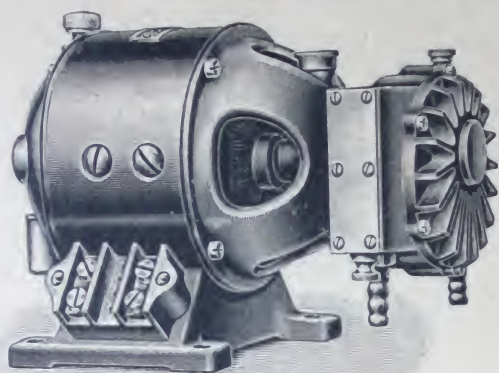
82 661—82 663. 1:6.

82 657. 2 Rotary Oil Air-Pumps with enclosed wheels, mounted on one board in series, one being used as a preliminary pre-vacuum pump. Size 2, Figure

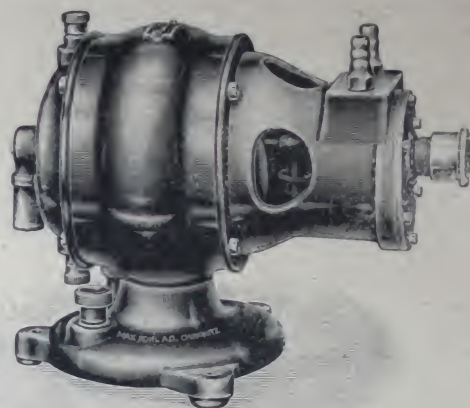
£ s. d.
20. 0. 0

Enclosed Air Pumps for Laboratories, Figures 82 658 and 82 659. Can also be used as Blowers.

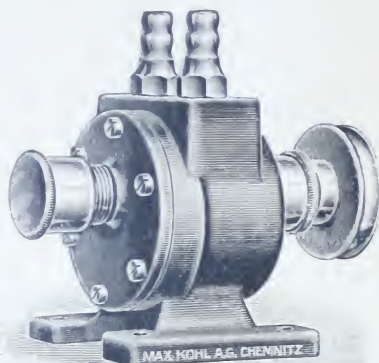
		Size 000	Size 00	Size 0
Outputs		Quantity of air exhausted with free passage		
	in 1 Minute	11 Litres	13 Litres	15 Litres
		Vacua attained in a Space of 1/2 l vol.		
	in 2 Minutes	12 mm	8 mm	3 mm
Number of Revolutions		400—500	300—400	200—400
Power required		1/8 HP	1/8 HP	1/8 HP
List No.		82 658	82 659	82 660
Price £		3. 0. 0	3. 15. 0	4. 10. 0
With 110 Volt D. C. Motor, Figure	List No.	82 661	82 662	82 663
	Price £	6. 10. 0	7. 5. 0	8. 0. 0
With 220 Volt D. C. Motor	List No.	82 664	82 665	82 666
	Price £	7. 0. 0	7. 15. 0	8. 10. 0
With Three-Phase Motor, 110 Volts	List No.	82 667	82 668	82 669
	Price £	6. 10. 0	7. 5. 0	8. 0. 0
With Three-Phase Motor, 220 Volts	List No.	82 670	82 671	82 672
	Price £	7. 0. 0	7. 15. 0	8. 10. 0
With Alternating Current Motor, 110 Volts	List No.	82 673	82 674	82 675
	Price £	7. 0. 0	7. 15. 0	8. 10. 0
With Alternating Current Motor, 220 Volts	List No.	82 676	82 677	82 678
	Price £	7. 10. 0	8. 5. 0	9. 0. 0



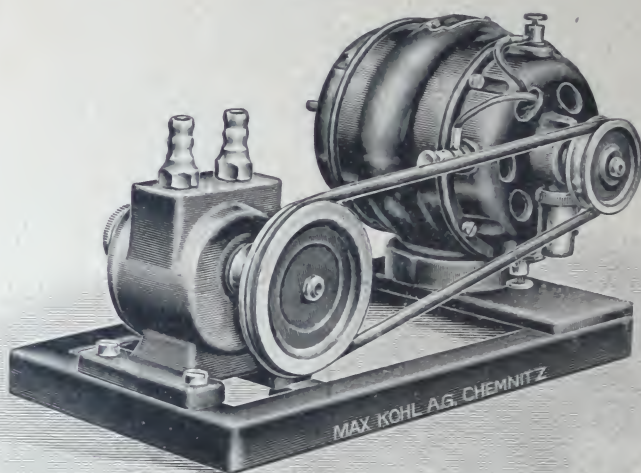
82679. 1:3.5.



82680. 1:4.5.



82681. 1:3.

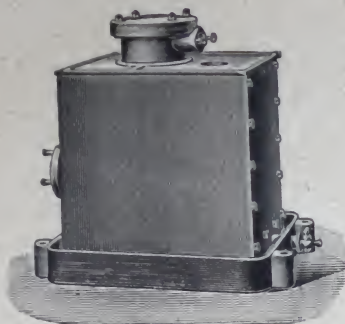


82682. 1:5.

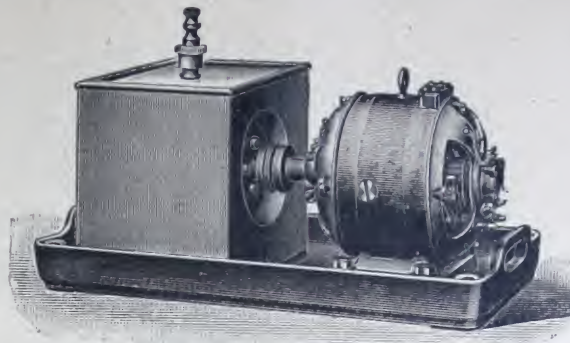
82679. **Motor-Driven Air Pump and Blower**, Figure, with 110 V. $\frac{1}{16}$ HP. Direct Current Motor. Output as a blower, 35 litres per minute with free air passage. Vacuum produced in a space of $\frac{1}{2}$ litre (500 c. c.) per minute, 340 mm. of mercury £ s. d.
6. 0. 0
82680. — **idem**, **larger**, Figure, with 110 V. $\frac{1}{8}$ HP. Direct Current Motor. Output as blower, 50 litres (50,000 c. c.). Vacuum produced in a space of 500 c. c., 320 mm. mercury column. 7. 10. 0
82681. **Rotary Blower**, Figure. Output with free air-passage 35 litres per minute. Power required, $\frac{1}{8}$ HP., speed 1200 r. p. m. 2. 10. 0
- Rotary Blower with Electric Motor**, Figure, the two mounted together on an iron frame. Output as No. 82681.
82682. — with 110 Volt **D. C. Motor** 6. 0. 0
82683. — with 220 Volt **D. C. Motor** 6. 10. 0
82684. — with **Three-Phase Motor**, 110 Volts 6. 0. 0
82685. — with **Three-Phase Motor**, 220 Volts 6. 10. 0
82686. — with **Alternating Current Motor**, 110 Volts 6. 10. 0
82687. — with **Alternating Current Motor**, 220 Volts 7. 0. 0

Rotary High-Vacuum Pump, Figure, on p. 1425. Encased Air-Pump for hand or motor drive. Vacua attainable, 0.05 mm. mercury column (Ztschr. f. d. phys. u. chem. U. **19**, 1906. p. 73).

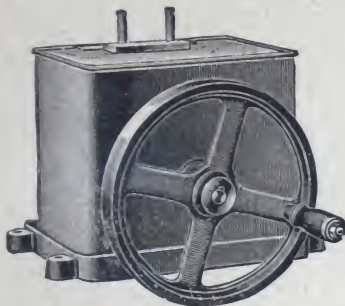
Power required	approx. H.P.	0,15	0,2		
Quantity of air (exhausted) with free air-passage per minute approx.		70 l	140 l		
Revolutions		400	400		
List No.		82688	82689		
Price		£ 15.10.0	18.10.0		
Power required	approx. H.P.	0,15	0,2		
Revolutions		1400	1350		
With 110 Volt D. C. Motor	List No.	82690	82691	220 Volt	List No.
	Price	£ 29.5.0	33.10.0		82692 82693
With Three-Phase Motor	List No.	82694	82695	220 Volt	List No.
	Price	£ 28.10.0	32.15.0		82696 82697
Revolutions		1400	1410		
110 Volt					



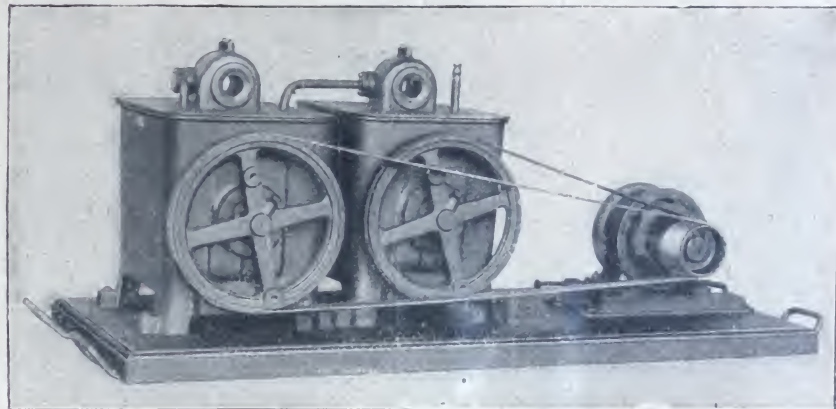
82 698 - 82 702. 1:15.



82 703 - 82 712. 1:10.



82 688, 82 689. 1:10.



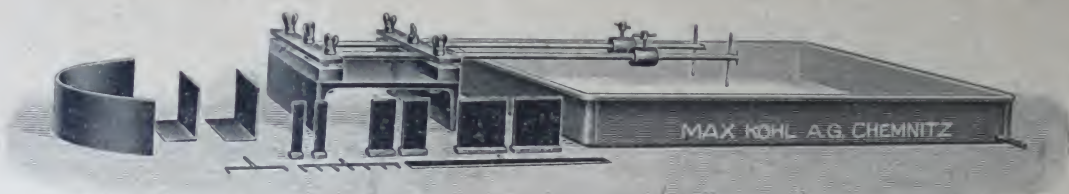
82 727, 82 729. 1:10.

Rotary Enclosed Air-Pumps with Oil Box, Figure, for hand or motor drive.

Vacuum attainable, mercury column mm.	2,5	2,5	1,5	1,5	1,5
Power required approx. H. P.	0,33	0,53	0,9	3,0	4,5
Revolutions	1500	1500	1000	800	800
Quantity of air exhausted with free air-passage per minute	145 l	320 l	520 l	1660 l	2670 l
List No.	82 698	82 699	82 700	82 701	82 702
Price £	14.10.0	16.0.0	30.15.0	63.10.0	71.10.0
Revolutions	1400	1350	1000	700	760
Quantity of air exhausted with free air-passage per minute	135 l	290 l	520 l	1450 l	2540 l
With 110 Volt D. C. Motor { List No.	82 703	82 704	82 705	82 706	82 707
Starter for above { Price £	25.15.0	28.10.0	47.5.0	106.15.0	121.5.0
Starter for above £	—	—	1.5.0	1.5.0	1.5.0
With 220 Volt D. C. Motor { List No.	82 708	82 709	82 710	82 711	82 712
Starter for above { Price £	25.15.0	28.10.0	47.5.0	106.15.0	121.5.0
Starter for above £	—	—	1.5.0	1.5.0	1.5.0
Revolutions	1410	1410	940	710	720
Quantity of air exhausted with free air-passage per minute	135 l	300 l	485 l	1470 l	2700 l
With Three-Phase Motor 110 Volts { List No.	82 713	82 714	82 715	82 716	82 717
Starter for above { Price £	25.10.0	28.10.0	43.10.0	93.10.0	107.5.0
Starter for above £	—	—	—	1.5.0	1.5.0
With Three-Phase Motor 220 Volts { List No.	82 718	82 719	82 720	82 721	82 722
Starter for above { Price £	25.10.0	28.10.0	43.10.0	93.10.0	107.5.0
Starter for above £	—	—	—	1.5.0	1.5.0

Two High Vacuum Pump with Electric Motor, Figure, on one board, one working as a preliminary pump. vacuum attainable, 0,001 mm mercury column.

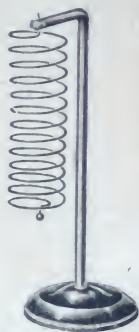
Power required approx. H. P.	0,27	0,34	. . . . .	0,27	0,34
Quality of air exhausted with free air-passage per minute	70 l	140 l	. . . . .	70 l	140 l
Revolutions	1350	1300	. . . . .	1350	1300
With 110 Volt D. C. Motor. { List No. 82723 82724			220 Volt { List No. 82725 82726		
Price £ 50.15.0 59.10.0				Price £ 50.15.0 59.10.0	
Revolutions	1410	1410	. . . . .	1410	1410
With Three-Phase Motor 110 Volts. { List No. 82727 82728			220 Volt { List No. 82729 82730		
Price £ 50.5.0 57.15.0				Price £ 50.5.0 57.15.0	



53150. 1:15.



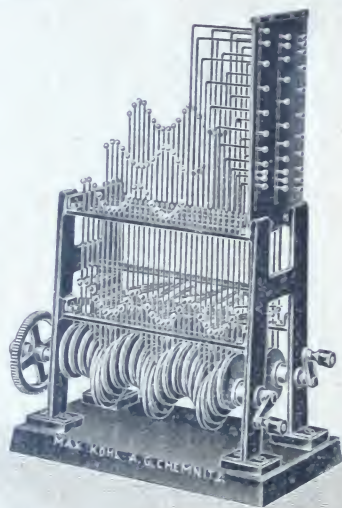
53163 A. 1:4.



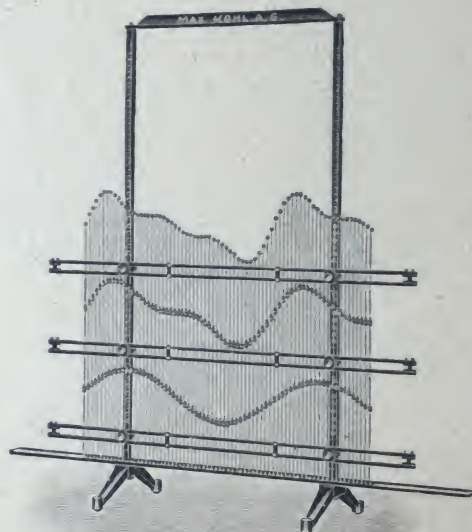
53163 B. 1:5.



53168. 1:12.



53171. 1:6.

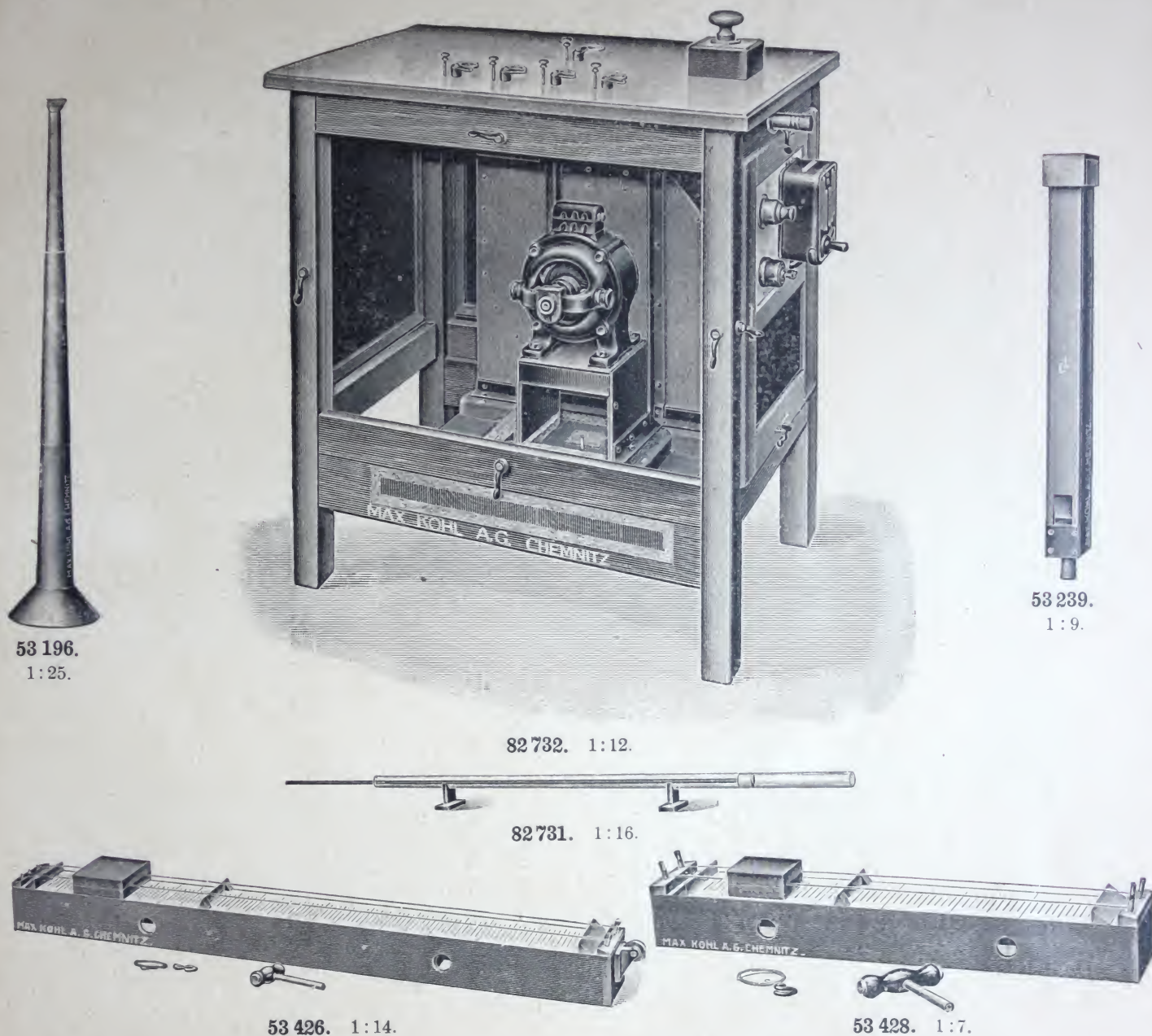


53182. 1:14.

Wave Motions.

- | | £ | d. | s. |
|---|----|-----|----|
| 53150. Apparatus for Demonstrating Wave Motions , after Grimsehl, Figure, (Ztschr. f. d. phys. u. chem. U. 19 , 1906, p. 271), for demonstrating the Propagation, Reflection, and Interference of Water Waves, Description | 3. | 15. | 0 |
| 53163. 2 Spiral Spring Models , Figure A and B, for imitating sound vibrations (M. T., Fig. 96) . | 0. | 6. | 0 |
| 53168. Rotary Screw Spiral after Friedr. C. G. Müller, Figure, for demonstrating progressive sine waves (M. T., p. 87) | 0. | 12. | 0 |
| 53171. Wave Machine after Steindel, Figure, for transverse and longitudinal waves and for demonstrating the interference of two waves (Ztschr. f. d. phys. u. chem. U. 23 , 1910, p. 289), Description | 9. | 0. | 0 |
| <p>On two horizontal axes, each having, a cranked handle at one end and a toothed wheel at the other the teeth of which mesh, are fitted two rows (one on each) of excentric discs which can be displaced relatively to each other through an angle of 45° or 36°. On rotating the discs about their horizontal axes a transverse wave-motion is set up in each of the two rows of rods placed vertically on the discs, and a longitudinal wave-motion at the ends of the rods whose ends are turned up at right angles, so that the direction of propagation of the waves is opposite in the two rows of rods. The excentrics can be displaced relatively to each other so as to vary mutually the phases of the waves. The rods of the two machines are connected together by levers and set a third row of rods into motion, thus showing the interference of the two wave-trains.</p> | | | |
| 53182. Wave Machine after Grimsehl, Figure, for the synthesis of vibrations, with the rod for the sine shaped wave of a fundamental tone and for two overtones (Ztschr. f. d. phys. u. chem. U. 17 , 1904, p. 34; Physikal. Ztschr., 1904), Description | 8. | 15. | 0 |

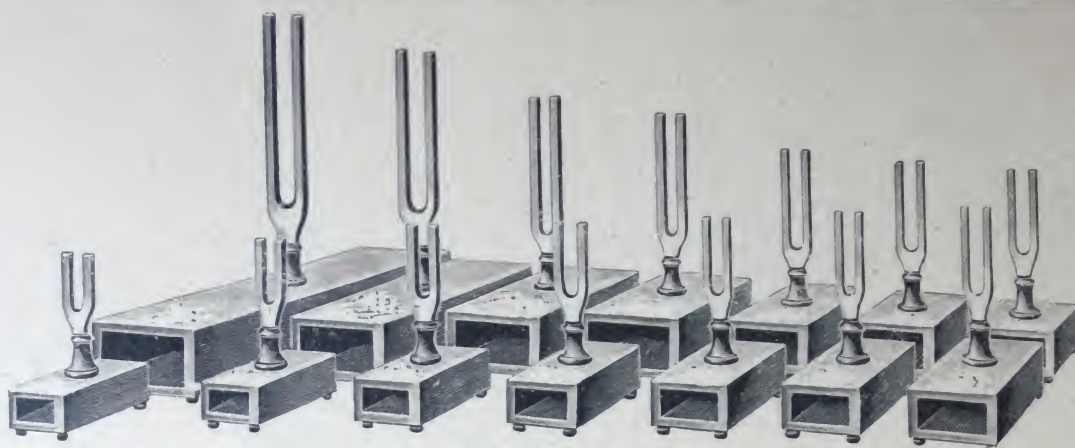
Cl. 7137,
6810, 6816, 7202,
6216, 6115.



Acoustics.

Propagation of Sound, Pressure Changes, Blowers, Vibrating Air Columns, Pipes, Sound Analysis.

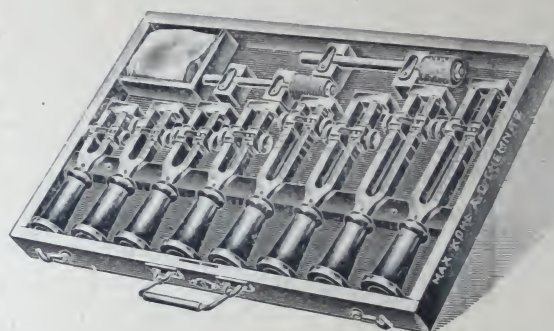
	£	s.	d.
53 196. Megaphone , Figure, 2 m long, carrying distance 1000 m (W. D., Fig. 202 [188]) . . .	0.	10.	0
82 731. Kündt Tube , with accessories, Figure (H. Sch. Fig. 157), for demonstrating horizontal air waves . . .	0.	5.	0
82 732. Blowing Table with Centrifugal Blower , Figure, with 4 valves for labial pipes, 1 valve for 1 large reed-pipe, and an opening for tonometer and wind chest . . .	24.	0.	0
The blower is driven by an electric motor the speed of which can be regulated by a starter. The blower runs practically noiselessly and supplies a smooth wind-pressure of 60 mm water-column. When ordering, please state the type of current and voltage of available supply.			
82 732 a. — idem, with 8 valves . . .	25.	0.	0
82 732 b. — idem, with 13 valves . . .	26.	0.	0
53 239. Labial Pipe of wood, to be used open and closed, Figure . . .	0.	10.	0
53 426. Monochord , Figure, useful string-length 1.2 m, with 3 strings, 2 with pegs and one with weight for stretching, with centimetre scale, movable bridge and damper clamp, of polished mahogany (only two strings are shown in illustration), without weights . . .	1.	16.	0
53 428. Monochord , smaller and simpler, with two strings stretched from pegs, Figure . . .	0.	15.	0



82733—82746. 1:10.



53384—53397. 1:10.



82752 a.

Tuning Forks.

Tuning Forks for Oscillatory Frequencies, Figure, for testing cables for telephone networks with Pupin coils, on resonance boxes.

List No.	82733	82734	82735	82736	82737	82738	82739	82740	82741	82742
Size:	1	2	3	4	5	6	7	8	9	10
Oscillatory Frequency:	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000
Price £	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0

List No.	82743	82744	82745	82746	82747	82748	82749	82750	82751	82752
Size:	11	12	13	14	15	16	17	18	19	20
Oscillatory Frequency:	8000	9000	10000	11000	12000	14000	15000	16000	18000	20000
Price £	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0

The tuning forks are accurately adjusted to the corresponding oscillations. In addition to the frequencies indicated, we can supply forks for any intermediate frequencies.

14 Tuning Forks with sliding weights, after Appunn, Figure, for producing the tones and semitones from c_{-1} to g_3 , in International Pitch, for testing church bells for their overtones.

List No.	53384	53385	53386	53387	53388	53389	53390
Size	1	2	3	4	5	6	7
Range of	$c_{-1}=64,6$	$e_{-1}=81,5$	$gis_{-1}=102,7$	$c_0=129,3$	$e_0=162,9$	$gis_0=205,3$	$c_1=258,7$
Tone	$cis_{-1}=68,5$	$f_{-1}=86,3$	$a_{-1}=108,8$	$cis_0=137$	$f_0=172,6$	$a_0=217,5$	$cis_1=274$
and	$d_{-1}=72,6$	$fis_{-1}=91,5$	$ais_{-1}=115,2$	$d_0=145,2$	$fis_0=182,9$	$ais_0=230,4$	$d_1=290,3$
compound	$dis_{-1}=76,9$	$g_{-1}=96,7$	$h_{-1}=122,1$	$dis_0=153,8$	$g_0=193,8$	$h_0=244,1$	$dis_1=307,6$
vibrations	$e_{-1}=81,5$	$gis_{-1}=102,7$	$c_0=129,3$	$e_0=162,9$	$gis_0=205,3$	$c_1=258,7$	$e_1=325,9$
Price £	2.10.0	2.6.0	2.4.0	2.4.0	2.4.0	2.4.0	2.4.0

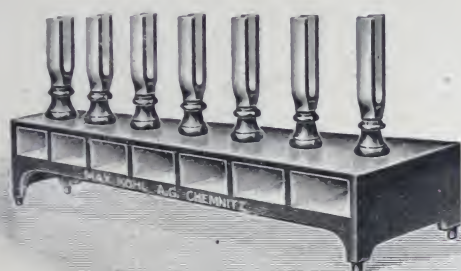
List No.	53391	53392	53393	53394	53395	53396	53397
Size	8	9	10	11	12	13	14
Range of	$e_1=325,9$	$gis_1=410,6$	$c_2=517,3$	$e_1=651,8$	$gis_2=821,2$	$c_3=1034,6$	$e_3=1303,5$
Tone	$f_1=345,3$	$a_1=435$	$cis_2=548,1$	$f_2=690,5$	$a_2=870$	$cis_3=1096,1$	$f_3=1381$
and	$fis_1=365,8$	$ais_1=460,9$	$d_2=580,7$	$fis_2=731,6$	$ais_2=921,7$	$d_3=1161,3$	$fis_3=1463,2$
compound	$g_1=387,5$	$h_1=488,3$	$dis_2=615,2$	$g_2=775,1$	$h_2=976,5$	$dis_3=1230,4$	$g_3=1550,2$
vibrations	$gis_1=410,6$	$c_2=517,3$	$e_2=651,8$	$gis_2=821,2$	$c_3=1034,6$	$e_3=1303,5$	$gis_3=1642,3$
Price £	2.4.0	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0	2.0.0

For testing a church bell as regards its overtones, a fork is struck and placed with the hollow base on the edge of the bell. If the overtone is present the bell rings.

82752 a. Box for storing above, Figure. Price according to number of forks £ 1.10.0 to 3.0.0



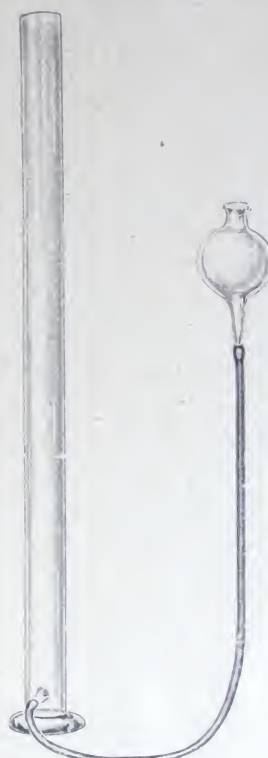
82753A. 1:8.



82753B. 1:8.



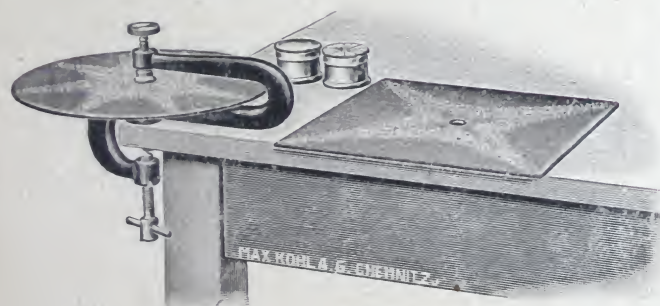
82754. 1:10.



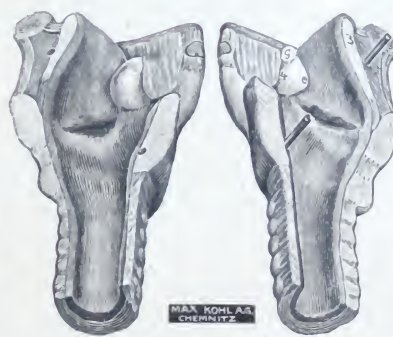
82755. 1:12.



82756. 1:15.



53438. 1:7.



53461. 1:3.



53462. 1:5.

82753. 15 Tuning Forks on 2 Resonance Boxes, Figures A and B, for the tones c_3 (1024), d_3 (1152), e_3 (1280), f_3 (1365 $\frac{1}{3}$), g_3 (1536), a_3 (1716 $\frac{2}{3}$), h_3 (1920), c_4 (2048), d_4 (2304), e_4 (2560), f_4 (2730 $\frac{2}{3}$), g_4 (3072), a_4 (3433 $\frac{1}{3}$), h_4 (3840), c_5 (4096) compound vibrations £ s. d. 20. 0.0

82753a. 4 Tuning Forks for proving the limit of audibility, c_4 , c_5 , c_6 , c_7 (ut_6 , ut_7 , ut_8 , ut_9), on a resonance box as No. 82753 3. 0.0

Vibrating Plates, Resonance Phenomena, Organs of Human Speech, Tone Variators,

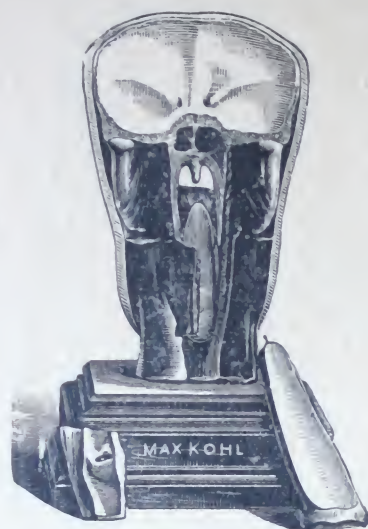
82754. Chemical Harmonicon, after Noack, Figure (Leitf. Fig. 12), for determining the pitch of a flame-tone 0. 18.0

82755. Resonance Tube with receiver and tubing, after Noack, Figure (Ztschr. f. d. phys. u. chem. U. 5, 1892, p. 275. — N. Leitf. Fig. 13. — N. Aufg. Fig. 21); Aufg. 46, for determining the wave-length λ and the velocity of sound in air 0. 8.6

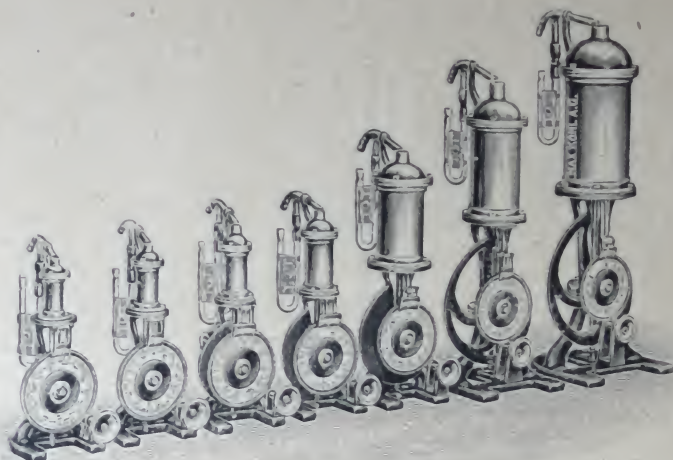
82756. Rotating Drum, Figure, for tuning fork curves, with stand (Ztschr. f. d. phys. u. chem. U. 7, 1894, p. 120; N. Leitf. Fig. 20); Aufg. 41 3. 15.0

The drum, capable of rotating about a perpendicular axis, has a crank at the top fitted with a slet. A heavy centrifugal pendulum, whose time of rotation is determined beforehand, sets the drum into regular rotation through the crank. When the outside of the drum has been coated with a uniform layer of lycopodium, the drum is revolved, and a tuning fork fitted with a style records on the drum during one whole rotation of the latter. This is done by slightly pressing the style against the drum. The number of vibrations a second of the tuning fork is given from the number of waves and the time of rotation of the drum.

Cl. 7332,
7331, 6797, 6798, 6752,
6916, 7141, 7142.



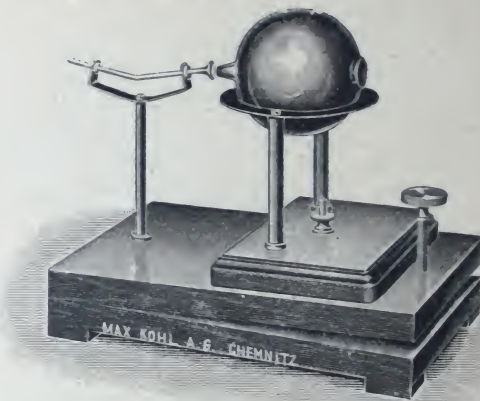
53 463. 1:4.



53 481a—53 487a. 1:15.



53 561. 1:9.



53 623. 1:6.

- 53 438. **Apparatus for Chladni's Figures**, Figure, on p. 1429, consisting of one iron clamp, one rectangular and one round glass slab 28 cm diameter, in box with sand and case of resin (W. D., Fig. 220 [206]), **Description** £ s. d.
 2. 2. 0
- 53 461. **Model of Larynx**, after Bock, simple, Figure, on p. 1429, **Description** 0. 6. 0
- 53 462. — idem, with hyoid bone, Figure on p. 1429, **Description** 0. 18. 0
- 53 463. — idem, with view of the pharyngeal space and nasal cavity, Figure, **Description** 0. 15. 0

Tone Variators after Prof. Dr. Stern, Figure, the tone being varied steadily and uniformly (Ztschr. f. Psychologie und Physiologie der Sinnesorgane, Vol. 30, 1902, p. 422), **Description**.

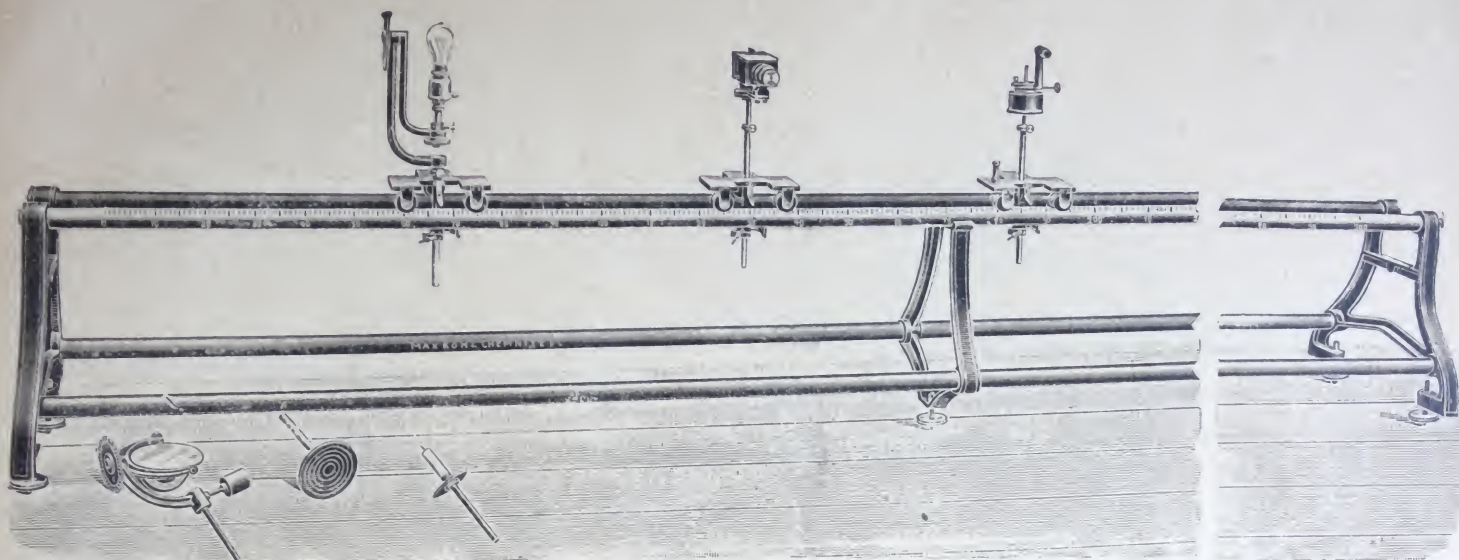
List No.	53 481a	53 482a	53 483a	53 484a	53 485a	53 486a	53 487a	
Size	1	2	3	4	5	6	7	
Compass	From 100	150	200	300	400	500	600	} compound vibrations
	To 165	300	400	600	800	1000	1200	
	£ 9.0.0	8.0.0	7.10.0	7.0.0	6.10.0	6.4.0	6.0.0	

The apparatus is suitable for **demonstration purposes** and for **tuning**, for **psychological investigations** and **practical investigations by otologists**.

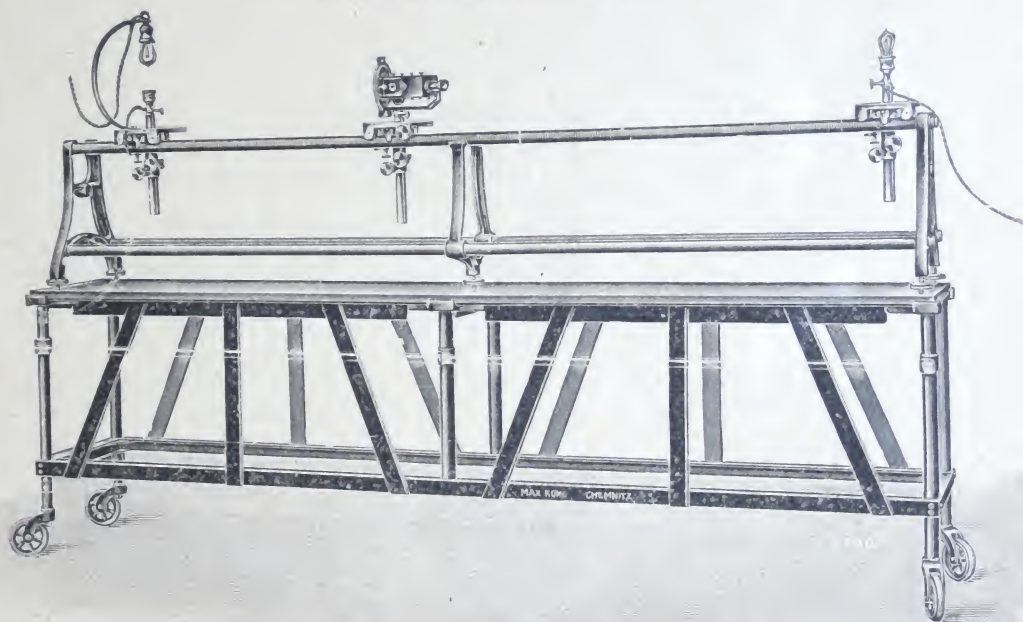
The tone variators are brass flasks with zinc cap and blowing tube. The flasks have an adjustable bottom which is raised by a spiral shaped disc in such manner that equal angles of rotation of the disc correspond to approximately the same variations in periodicity. The periodicities can be read off direct on the dial. In addition to the values of the periodicities, the musical tones in International Pitch are given on the dial.

For observing the pressure when blowing, every tone variator is provided with a pressure gauge on the scale of which is marked the pressure to which the tone variator is adjusted.

- 53 561. **2 Tuning Forks with Recording Device on Wood Stand**, Figure, $c_0 = 128$ compound vibrations ($ut_2 = 256$ v. s.), one fork fixed, the other movable and provided with sliders, for graphically demonstrating the vibrations of two tuning forks (M. P., I, Figs. 806 and 807 [830 and 831]) 6. 0. 0
- By means of the sliders one fork can be altered in relation to the other by 4 : 5.
- 53 623. **Phonometer** after Dvořák, Figure, on stand and with tilting board, **Description** 0. 12. 0



82 757, 82 793, 82 797. 1:16.



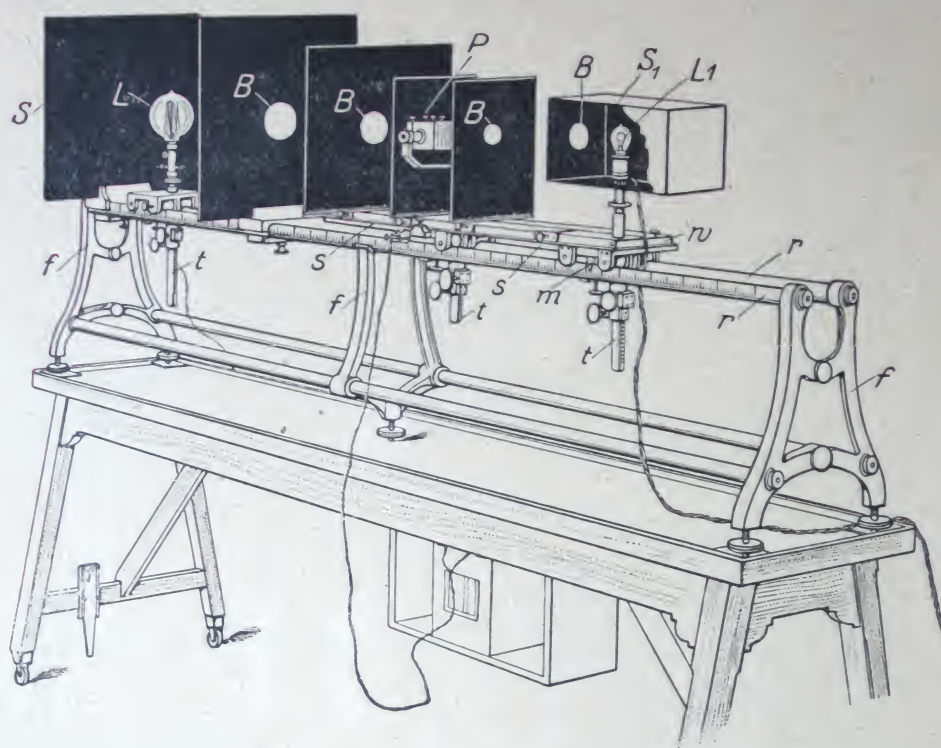
53 659, 82 757. 1:23.

Optics.

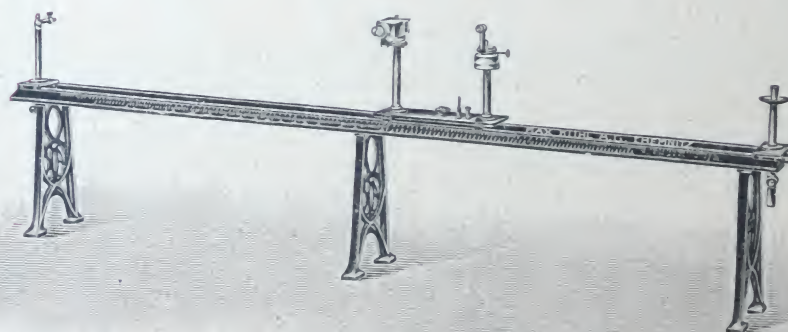
Photometry Apparatus.

Photometer Benches and Accessories.

82 757. Large Precision Photometer Bench, Figure, built on data supplied by the Physikalisch-Technische Reichsanstalt (the German "National Physical Laboratory"). The bench comprises two stout steel tubes 3,18 metres (about 10 $\frac{1}{4}$ ft.) length, one of which has a millimetre scale engraved on it, with three tube stands (adjustable by rack and pionion vertically) on three carriages with rollers, pointer and fine-adjusting device	£	s.	d.
		25.	0.0
82 758. — idem, with three steel tubes 4.5 metres (about 14 ft. 3 ins.) length		32.	10.0
Extra Price for light-ratio graduation 0.1—200 on the second steel tube for the 3 metre long bench . .		2.	0.0
— idem, for the 4.5 metre Bench		2.	10.0
53 659. Portable Iron Table for the large Photometer Bench No. 82 757, Figure. Price exclusive of photometer bench		17.	0.0



82759, 82757, 82762. 1:25.

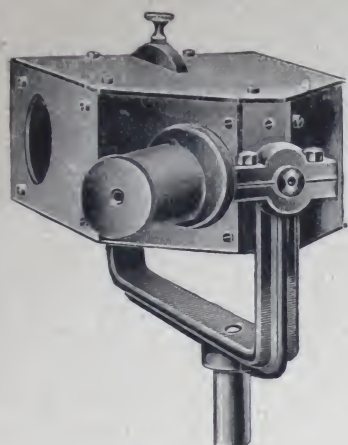


82760, 82761. 1:25.

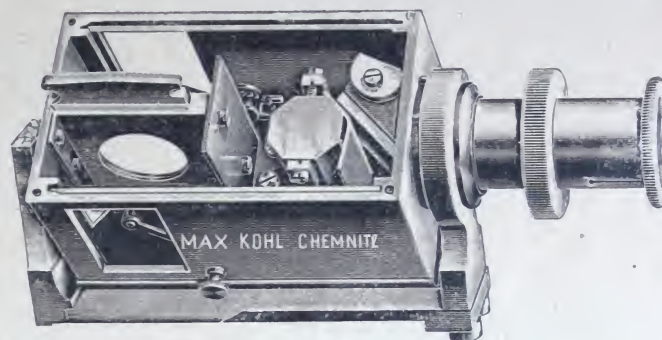
82759. **Portable Wood Table for the large Photometer Bench, No. 82757, Figure. Without photometer Bench** £ s. d.
7. 0. 0

82760. **Photometer Bench, Figure, (slightly different design.)** length of bench 2,5 metres (about 8 ft.). Constructed of angle irons with iron legs, wood scale graduated in half-centimetres and light-ratio graduation from 0,1 to 150; two carriages for photometer head and comparison source of light capable of being coupled at a distance of from 54—66 cm (about 22" to 27"). This bench is designed mainly for photometering electric incandescent lamps in accordance with the regulations of the "Verband deutscher Elektrotechniker" (Resolution of 26 th May, 1910) (Elektrotechn. Ztschr. 1910, p. 303 and 714). It is equipped with: 1 simple glow-lamp stand for the comparison source of light. 1 rotary glow-lamp holder for a vertically supported lamp. With Motor, and 1 Lummer-Brodhun photometer head for equality, with direct vision 20. 0. 0

Extra Price for photometer head arranged for equality and contrast 1. 0. 0



82766. 1:2.



82764. 2:5.

82761. **Photometer Bench for Incandescent Electric Lamps and Gas Burners**, Figure on p. 1432. £ s. d.
Length of bench, 2,5 metres (about 8 ft.) wood scale with two light-ratio graduations, the top one going from the middle (= 1) in both directions to 200; the bottom one, from 1—50; with two stands adjustable up-and-down by rack and pinion, on both ends of the bench for the Hefner (or other standard) lamp and the glow lamp (or gas burner) to be tested; one carriage with two stands for the photometer head and for the Hefner lamp. The bench is fitted with 1 Lummer-Brodhun equality Photometer Head No. 82764 15. 15. 0

For suitable Hefner Standard Lamp for above, see Nos. 82775 — 82781, p. 1435.

The bench can be used for photometering in two different ways, as follows: (1) The two light sources to be compared are fixed on the fixed stands at the ends of the bench and the carriage containing the photometer head slipped along until equality is observed. The reading in this case is taken on the top scale. (2) The Hefner lamp is set up on the carriage alongside the photometer head, and the lamp to be tested on the left-hand end of the bench. The reading in this case is taken on the lower scale.

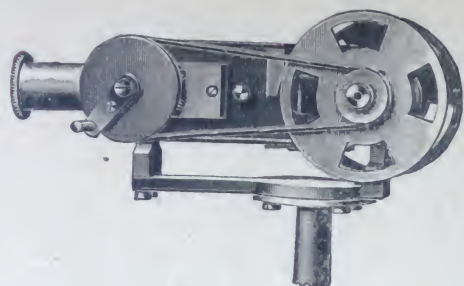
82762. **8 Diaphragmic Discs**, 6 with holes, for keeping off secondary light. The diaphragms are of metal, velvet-lined, on riders, f. Figure on p. 1432 9. 12. 0
82763. **1 Metal Frame** for connecting up two carriages at variable distance 1. 10. 0

Accessories for above Photometric Apparatus.

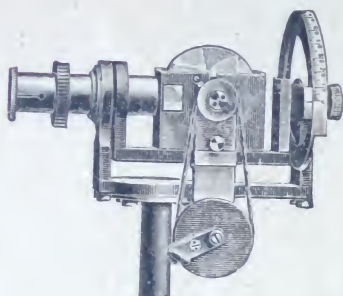
Photometer Heads.

82764. **Photometer Head** (Lummer-Brodhun's, Figure, with peep-hole **perpendicular** to the luminous sources, with setting to **equality** 6. 5. 0
82765. — idem, with setting for equality and contrast. Prismatic cubes with figures blown in 7. 5. 0
82766. **Photometer Head** (Lummer-Brodhun's, Figure, with **oblique** peep-hole, with setting to equality 5. 0. 0
82767. — idem, with setting to equality and contrast, Prismatic cubes with figures blown in 6. 0. 0
Extra Price for fitting a **divided vertical circle** for photometering luminous sources at different angles on preceding photometer heads 1. 5. 0
Extra Price for fitting 3 smoked glasses to the above photometer heads; each glass 0.2 permeability 2. 5. 0
Extra Price for Photometer Heads 82764 and 82765 when fitted with an arrangement for observing with both eyes. For No. 82764 6. 5. 0
For No. 82765 7. 5. 0

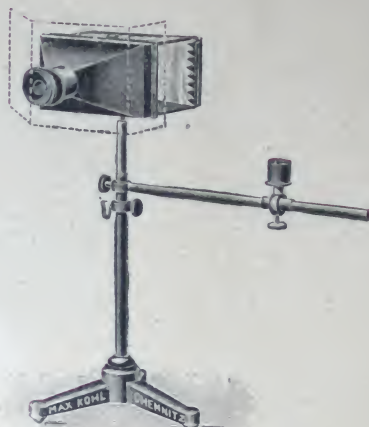
When observing with both eyes the difference in sensitivity is much greater.



53 650. 1:2.



53 650 a. 1:2.



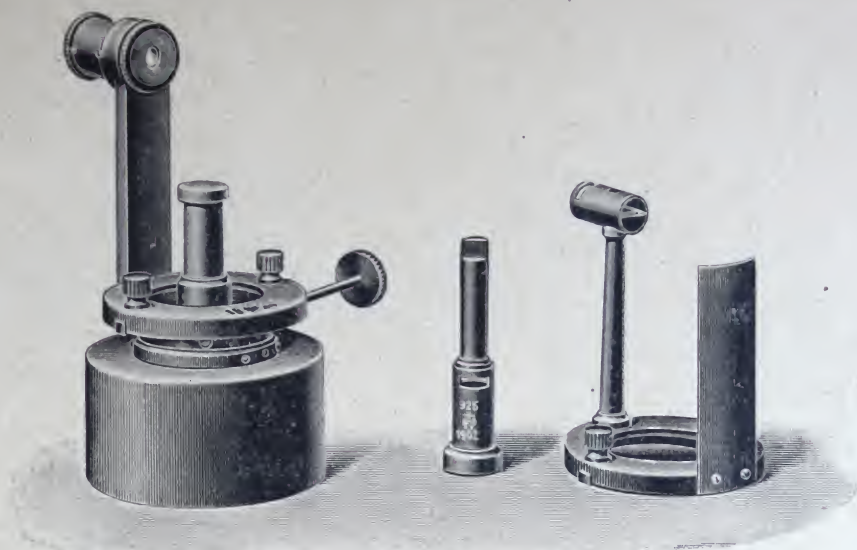
82 770. 1:4.



82 772. 1:8.

82 768. Photometer Head after Bechstein, folding type, with straight gypsum bodies, for setting to equality and contrast	£ s. d.
	13. 5. 0
82 769. — idem, with divided vertical circle, for photometering sources of light at different angles	17. 10. 0
53 650. Flicker Photometer Head , Figure, with sector disc	5. 0. 0
53 650 a. — idem, with rotating flicker body , Figure, with inclining device and degree graduation, for measurements in divergence directions	7. 10. 0
53 650 b. Motor Drive for the preceding Flicker Photometer Heads, with D. C. 110 Volt Motor and regulating resistance	2. 10. 0
<p>The principle of the flicker photometer is as follows. The eye does not perceive either of two stimuli when they follow each other rapidly, but a merging of the two. A flicker is always observed when a surface is alternately lighted by two luminous sources of different intensity and where the change between the two does not take place rapidly enough to allow the two to merge into one stimulus. On the other hand, there is no flicker where both luminous intensities are equal.</p> <p>The flicker photometer head is therefore set up between the two sources of light at both ends of the bench so that no flickering is observed where the alternations of the two luminous effects are moderate.</p>	
82 770. Photometer Head (Bunsen's) Figure. The spot screen is reversible. With two inclined mirrors in a sheet metal casing open on both sides. Without stand or lateral candle holder	1. 15. 0
82 771. — idem, with rotary casing	2. 10. 0
82 772. — idem, Figure, the rotary casing being fitted with divided circle, so as to enable luminous sources to be measured at different angles. Without stand	3. 5. 0
82 773. Spot Screen for the Bunsen Photometer. Each	0. 0. 6
82 774. Prism Photometer Head after Krüss	4. 5. 0

The two images of the Bunsen spot are divided by a sharp line, thus facilitating comparison.



82780. 1:2.

Units of Light and Comparison sources of light.

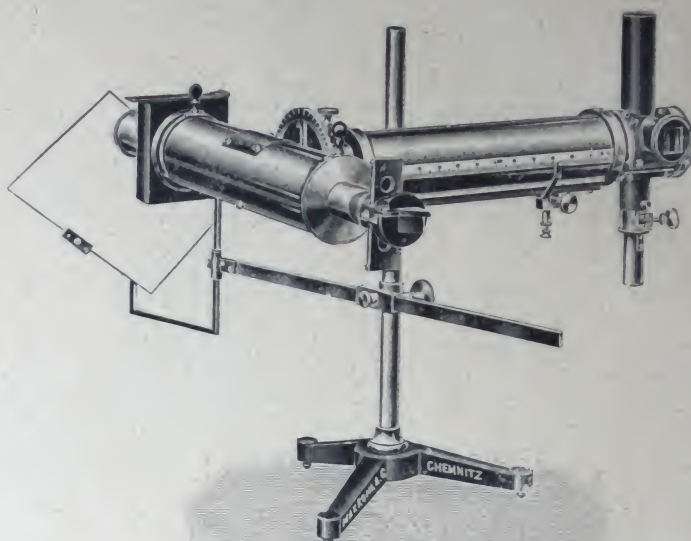
	£	s.	d.
82775. Hefner Lampe , Amyl Acetate Lamp, admitted for test by the Physikalisch-Technische Reichsanstalt (Ztschr. für Instrumentenkunde, 13 , p. 257), with optical flame measuring apparatus (after Krüss), check gauge and scissors, Description	2.	0.	0.
82776. — idem, verified	2.	10.	0.
82777. — idem, with flame meter after v. Hefner-Altenneck, check gauge and scissors, Description	2.	0.	0.
82778. — idem, verified	2.	10.	0.
82779. — with 2 flame measuring apparatus, check gauge and scissors, cf. Fig. 82780, Description	2.	9.	0.
82780. — idem, verified, Figure	2.	19.	0.
82781. Spare Wick Tube for the Hefner Lamp , verified	0.	6.	0.
82782. Standard Metal Filament Glow Lamps of approx. 10, 16, 25 and 32 Candles (Hefner), specially for photometering glow lamps with Apparatus No. 53656, for an accurately prescribed voltage each	0.	12.	0.
<p>These comparison glow lamps are supplied calibrated at an accurately prescribed voltage and for a luminous intensity in one direction, approximately as ordered, e. g. for 16.6 Standard Candles (Hefner) at 110 volts. The lamps are supplied for the usual voltages; 110, 120, 150 and 220 volts. When ordering the voltage available and desired candle power should be stated; in every case only one of these two values can be strictly adhered to. — It is advisable always to obtain 2 comparison lamps of the same sort, keeping one as a master standard, and comparing it from time to time with the standard in use.</p>			
82783. — idem, calibrated for an accurately prescribed Candle-power in one direction, for working on the photometer bench each	0.	12.	0.
<p>If accurate measurements are desired with these glow lamps—especially in the photometry of arc light—the voltage obtained for the candle-power in question when calibrated must be adhered to.</p>			
82784. — idem, calibrated for an accurately prescribed mean horizontal Candle-power , for glow lamp measurements, in accordance with the rules of the Verband Deutscher Elektrotechniker, on Photometer Bench No. 82757, 82760 and with the aid of the Angle Mirror No. 82789 each	0.	12.	0.
82785. — idem, calibrated for a prescribed mean hemispherical candle power . These lamps are necessary for measurements with the Ulbricht spherical photometer No. 82814 each	0.	12.	0.
<p>If desired, these lamps are supplied with the Certificate of Test of the Physikalisch-Technische Reichsanstalt on payment of the necessary fees.</p>			
82786. Centered Paraffin Lamp , with round burner as comparison source of light for stronger luminous sources	0.	10.	0.
82787. Glass Plates , red, green, blue. Per square decimetre	0.	1.	0.
82788. Glass Plates of ruby glass. Per square decimetre	0.	1.	6.



82 802.



82 803.



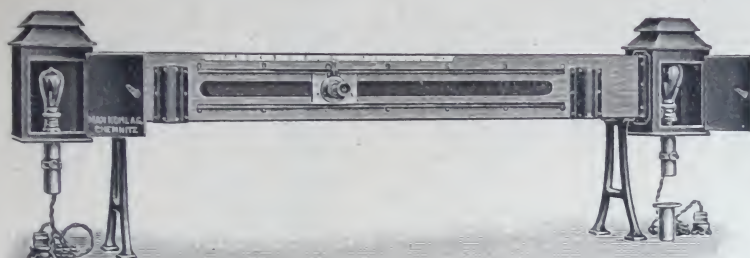
53 654. 1:9.

Auxiliary Apparatus for Photometering.

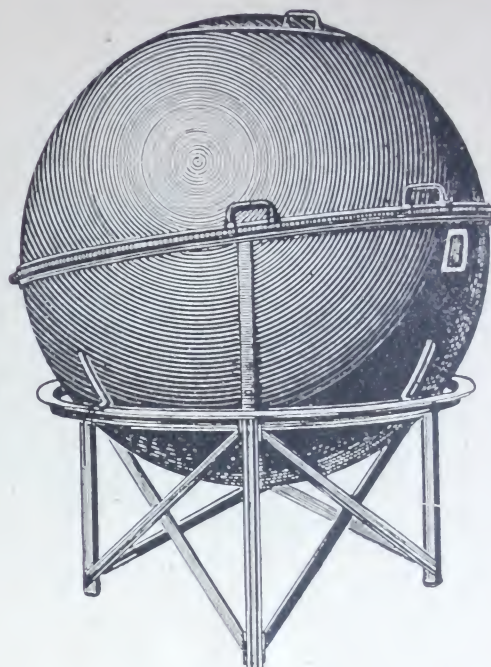
	£	s.	d.
82 789. Angle Mirror , for determining the mean horizontal candle-power of a glow lamp in accordance with the regulations of the "Verband deutscher Elektrotechniker". Glow lamp holder, with Edison screw socket, adjustable vertically	1.	16.	0
82 790. Rotating Device for a vertical lamp. For driving by electric motor. Price, without motor	5.	0	0
82 791. Electric Motor for above, for cord drive through spur gearing	5.	0.	0
82 792. Rotating Duplex Mirror after Brodhun, for a fixed, horizontal glow lamp. Price, including motor	12.	0.	0
82 793. Glow Lamp Photometering Stand for rotating through the horizontal plane. Tilt read off on a divided circle, Figure on p. 1431	2.	10.	0
82 794. — idem, Rotation through horizontal and vertical plane read off on divided circles	5.	0.	0
82 795. 45° Mirror (i. e., tilted at 45° to Horizontal). The mirror rotates about this horizontal axis and the rotation read off on divided circle. With mirror about 8" diameter	2.	10.	0
82 796. — idem, with mirror about 20" diameter	5.	10.	0
82 797. Auxiliary Mirror rotary about all planes, with divided circle and degree arc, Figure on p. 1431	6.	0.	0
82 798. Photometering Stand with 2 Brodhun mirrors (Liebenthal, Praktische Photometrie, p. 292), for luminous sources to 24" diameter	42.	10.	0
82 799. — idem, for luminous sources to 20" diam.	35.	0.	0
82 800. — idem, for luminous sources to 16" diam.	30.	0.	0
82 801. — idem, for luminous sources to 12" diam.	25.	0.	0

Auxiliary Apparatus for Photometering Gas Lamps.

82 802. Experimental Gas Meter , Figure, for a flow of gas of 750 litres (about 0.0200 cu. ft.) per hour, with level, levelling-screws, pressure gauge and fine-adjustment cock (the actual design differs from the illustration)	6.	0.	0
82 803. Experimental Governor (Pressure Regulator), on stand, Figure	2.	15.	0
82 804. Seconds Clock with arrestment and return to zero	1.	4.	0
82 805. Standard Argand Burner , with 32 holes	0.	10.	0
82 806. Cylinder with Graduation for same	0.	2.	0



53 656. 1:15.



82 815. 1:25.

Portable Photometers.

- 53 654. **Photometer** after Leonh. Weber, Figure, on p. 1436, with complete accessories, in polished wood box, **Description** £ s. d.
20. 0.0

The photometer is based on the comparison of two illuminated ground discs, one of which is arranged so as to be movable in a horizontal tube; the tube perpendicular to the latter tube, and containing the other ground disc, contains a Lummer-Brodhun Cube, is arranged to rotate, and can be conveniently focussed on the luminous source to be investigated. A graduated arc permits the angle described to be read off. As comparison light source use is made of a small benzine lamp having a flame-height of 20 mm; the correct height can be read off on a scale pasted on plate glass, and can be adjusted by a rack.

- 82 807. — idem, with prismatic cube for equality and contrast 21. 5.0

Accessories for Weber Photometers.

- 82 808. **Incandescent Electric Lamp**, in case, with pole terminals. May be substituted for the case containing the petrol lamp 2. 0.0
82 809. **Supply Set**, comprising accumulator, ammeter and rheostat, for operating Glow Lamps. In case 4.10.0
82 810. **Tripod Stand**, wood, for setting up the Weber photometer 2.10.0

- 82 811. **Tube Photometer**, Improved Weber Opal-glass Photometer, latest design (Zeitschrift für Instrumentenkunde 1907, p. 182). With Lummer-Brodhun prismatic cube for equality and contrast, with opal-glass plate arranged to turn at a varying rate in the tube; with percentage scale, electrical measuring lamp in case with adjusting device, one Weber plate box with circle and index, two, smoked glasses in mount; screen comprising a gypsum plate and an opal-glass plate (interchangeable), with a round type level for setting in a horizontal position. The entire instrument is fitted in a carrying case 50. 0.0

- 82 812. **Polarisation Photometer** after Prof. Dr. Weber, for measuring the light emitted by celestial bodies (Zeitschrift für Instrumentenkunde 1891, p. 6), with divided circle, for setting to equality 45. 0.0

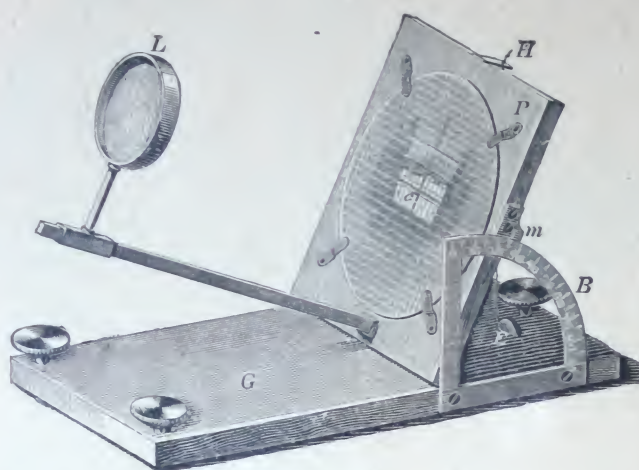
- 82 813. — idem, for equality and contrast, Figure 46.10.0

Ulbricht's Spherical Photometer (Elektrotechnische Zeitschrift 1900, p. 595, 1905, p. 512, 1906, p. 50, 1907, p. 777). Figure, with opening at the top for introducing the source of light, opal-glass observation window, standard lamp-holder, and sliding diaphragm.

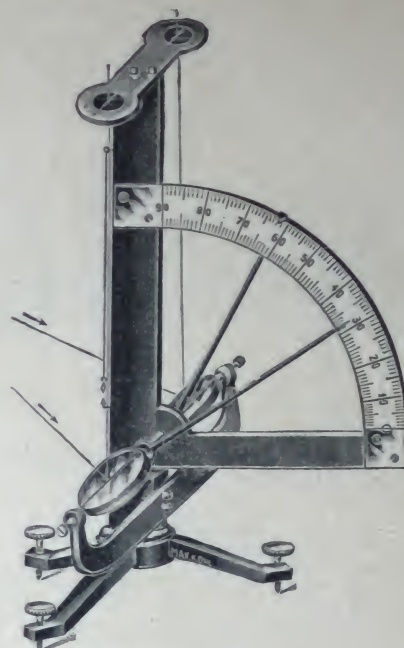
List No:	82 815	82 816	82 817	82 818
Size:	1	2	3	4
Diamr. of Sphere. ins.	20	40	60	80
Price £	17.10.0	25.0.0	32.10.0	40.0.0

Ulbricht's spherical photometer is used for measuring the mean hemispherical candle-power of any source of light by a single measurement. It consists of a hollow metal globe the inside of which is coated with a dull white substance. At the side of the globe is an opal-glass window for observing the brightness inside the globe caused by the source of light in it. The readings are taken on the photometer bench with the Weber opal-glass photometer or the Lummer-Brodhun photometer.

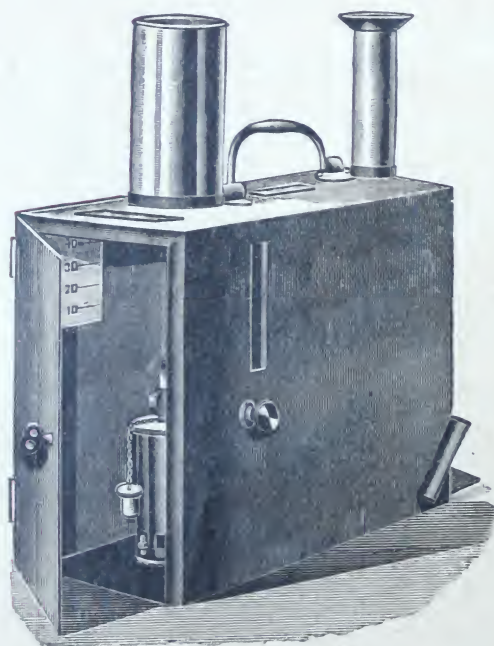
- 82 819. **Apparatus for Testing the Centre of Gravity of Light**, after Ulbricht (Elektrotechn. Zeitschrift 1907, p. 717) 1.10.0



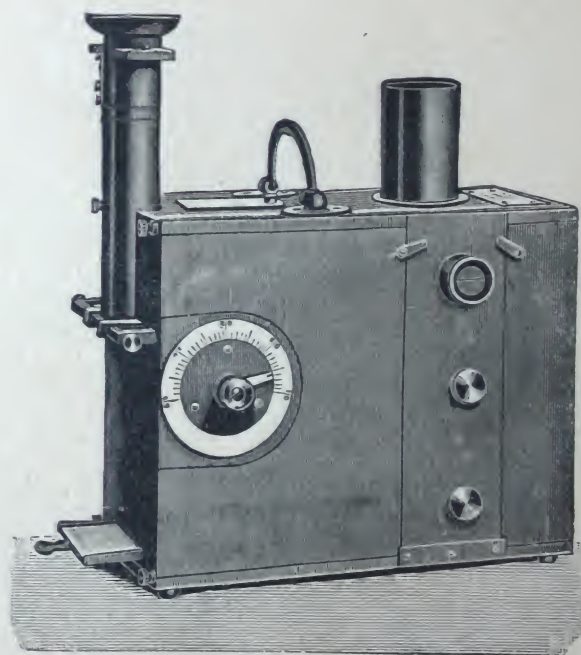
53 629. 1:2.



53 630. 1:3.



53 631. 1:6.



53 633. 1:5.

53 656. **Glow Lamp Photometer**, Figure, on p. 1437, with comparison apparatus on Joly's principle

£ s. d.
7.10.0

The photometer is 1 m long and is arranged in such manner that the candle powers of glow lamps can be compared without a dark room, the ratio of intensity being read direct on a scale. The range extends in both directions from 1 to 10 times. The exchange of the glow lamps under test proceeds very rapidly. Calibrated glow lamps are used as standards. The apparatus is fitted with Edison Glow lamps sockets, but can be arranged for any other holder.

Comparison Glow Lamps — see Nos. 82782 — 82784.

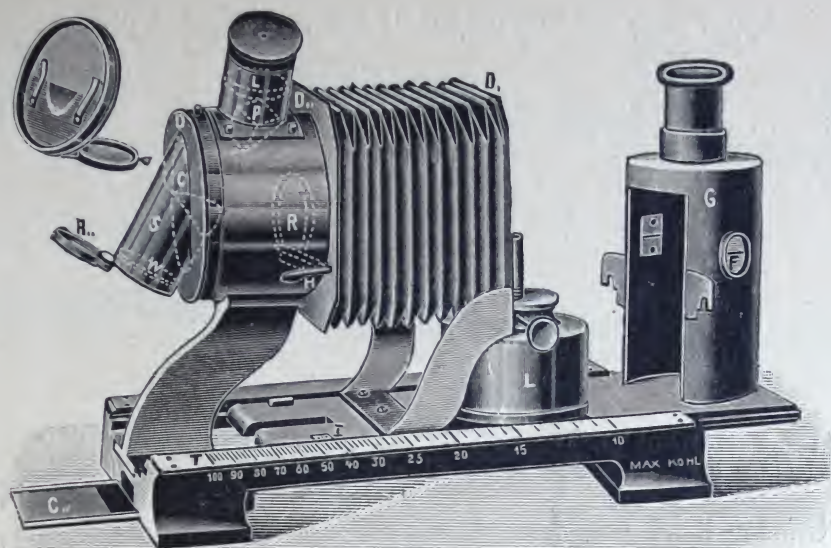
Apparatus, etc. for Determining the Lighting of Workshops.

53 629. **Light-Angle-Measurer** after Weber, Figure, for determining the luminosity of places (Ztschr. für Instrumentenkunde 4, 1884, p. 343), can be folded up

4.10.0

This apparatus is used for measuring the angle from which the open sky is visible from the place being investigated, and the angle of elevation at which the light falls upon the place.

Cl. 1204, 1205,
5930, 5929.



53 634. 3:10.

- | | | | |
|--|----|----|----|
| 53 630. Aperture Goniometer after Gotschlich, Figure on p. 1438, for the same purpose, giving simultaneously the upper and central angle of incidence, Description | £ | s. | d. |
| | 2. | 4. | 0 |

The apparatus consists of a stand with graduated arc in the centre of which are two rotary mirrors. The axes of rotation of the mirrors are indicated by engraved lines. Two pointers are connected with the mirrors and show the predominating inclination on the graduated arc. By means of a spectacle-shaped sighting arrangement with fine threads a sight is taken of the mirror which is adjusted in such manner that the engraved axes of the one mirror falls in a line with the upper edge of the window, while the axis of the other is made to coincide with the ridge of the opposite house. The portion of the arc situated between the two pointers is equal to half the angle of aperture.

- | | | | |
|--|----|----|---|
| 53 631. Photometer after Wingen, Figure, on p. 1438, for directly determining the luminosity of workplaces in metric candles (range 10—50 metric candles), Description | 2. | 0. | 0 |
|--|----|----|---|

The area to be investigated is compared by observing with a red glass with a rotary surface inside the apparatus, this latter surface being illuminated by a small benzene lamp, the height of flame of which can be regulated. By rotating the comparison area relatively to this lamp, an external pointer is actuated, and permits the luminous value of the area investigated to be read off on a scale direct in metric candles.

- | | |
|--|----------|
| 53632. Carrying Case for above, lock-up, with handle | 0. 10. 0 |
|--|----------|

- | | |
|---|----------|
| 82 820. Brightness Tester after Dr. Thorner. In case | 2. 10. 0 |
|---|----------|

- | | |
|--|---------|
| 53 633. Photometer after Wingen, for determining intrinsic brilliancy, Figure; benzene lamp with optical flame measuring apparatus after Krüss, for a range of 1—500 metric candles, Description | 4. 0. 0 |
|--|---------|

This photometer is constructed on the same principle as the preceding apparatus, but admits of more accurate and extensive measurements.

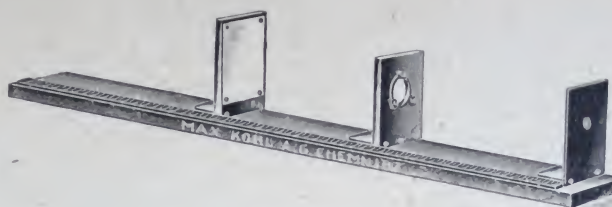
- 53 634. Apparatus for Measuring Surface Brightness, Figure, with Hefner Lamp, Description . . 10. 10. 0

Apparatus for Equipment of the Photometer Room.

	£	s.	d.
82760. 1 Photometer Bench , length of bench 2,5 metres (about 8 ft in length). Constructed of angle irons with iron legs, wood scale graduated in half centimetres and light-ratio graduation from 0.1—150; two carriages for photometer head and comparison source of light capable of being coupled at a distance of from 54—66 cm (about 22" to 27"). This bench is designed mainly for photometering electric incandescent lamps in accordance with the regulations of the „Verband deutscher Elektrotechniker“ (Resolution of 26 th May, 1910, E. T. Z. 1910, pp. 303 and 714); it is equipped with: 1 simple glow-lamp stand for the comparison source of light, 1 rotary glow-lamp holder for a vertically supported lamp with motor and 1 Lummer-Brodhun photometer head for equality, with direct vision			20.0.0
Extra price for photometer head arranged for equality and contrast	£	1.	0.0
82770. 1 Photometer Head (Bunsen's). The spot screen is reversible. With two inclined mirrors in a sheet metal casing open on both sides		1.15.	0
53650. 1 Flicker Photometer Head		5.	0.0
53650a. 1 idem , with rotating flicker body		7.10.	0
82775. 1 Hefner Lamp , with optical flame measuring apparatus after Krüss, check gauge and scissors, admitted for test by the Physikalisch-Technische Reichsanstalt		2.10.	0
82781. 1 Spare Wick Tube for the Hefner Lamp , verified		0.	6.0
82782. 4 Standard Metal Filament Glow Lamps of approx 10, 16, 25 and 32 Candles (Hefner) for 120 Volts		2.	8.0
82789. 1 Angle Mirror for determining the mean horizontal candle power of a glow lamp, adjustable vertically		1.16.	0
82792. 1 Rotating Duplex Mirror after Brodhun, for a fixed, horizontal glow lamp. Price, including motor		12.	0.0
82793. 1 Glow Lamp Photometering Stand , for rotating through the horizontal plane, with divided circle		2.10.	0
82795. 1 45° Mirror (i. e., tilted at 45° to Horizontal). The mirror rotates about this horizontal axis and the rotation is read off on divided circle. With mirror about 8" diameter		2.10.	0
53654. 1 Photometer after Prof. Dr. Weber, with complete accessories and in polished wood box		20.	0.0
53656. 1 Glow Lamp Photometer with comparison apparatus on Joly's principle		7.10.	0
53629. 1 Light-Angle-Measurer after Weber for determining the luminosity of places		4.10.	0
53633. 1 Photometer after Wingen for directly determining luminosities		4.	0.0
		94.	5.0



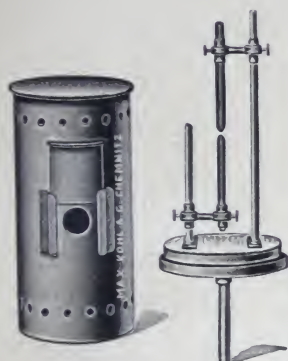
82821. 1:6.



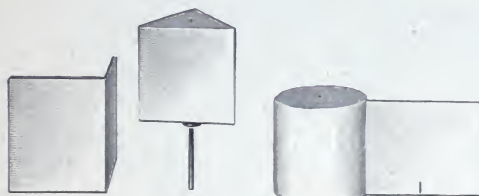
82822. 1:14.



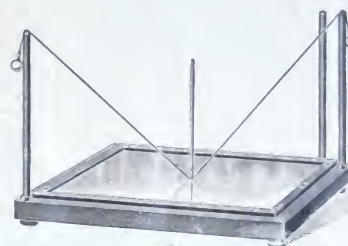
53696. 1:20.



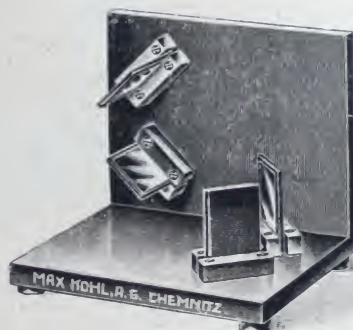
53704. 1:8.



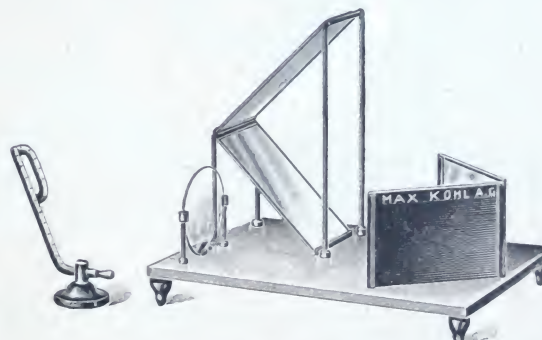
53705. 1:8.



53712. 1:10.



53714. 1:14.



82823.

Propagation and Intensity of Light.

	£	s.	d.
82821. Photometer , Figure (N. Leitf., Fig. 20), Aufg. 74—77	0.	10.	0
53696. Optical Bench after Friedr. C. G. Müller, Figure (M. T., Fig. 114 and pp. 166 to 171, 173, 174, 175), 3 m long, with 4 saddle-stands	1.	10.	0
82822. Optical Bench , Figure (H. Sch., Fig. 193), with white screen, lens in mount and object (wire netting)	0.	8.	8
53704. Arc Light Lantern (M. T., Fig. 120) after Friedr. C. G. Müller, Figure	1.	4.	0
53705. Prism, Disc and Cylinder of Cardboard , for showing the dependence of the luminous intensity on the angle of incidence and for photometric experiments (M. T., Figs. 125 [126]), Figure	0.	4.	0

Reflection of Light.

53712. Reflection Apparatus after Friedr. C. G. Müller (M. T., Fig. 127), Figure, for showing that the reflected ray lies in one plane with the incident ray and with the axis of incidence	0.	18.	0
53714. Mirror Arrangement after Porro (M. T., Fig. 129), for reversing an image, Figure	0.	16.	0
82823. Weinhold's Arrangement of Mirrors , Figure (W. D. 1913, Fig. 367, p. 495), for explaining the Porro arrangement of prisms for erect images in telescopes. The mirrors take the place of the total reflecting surfaces of the Porro prisms	3.	10.	0

Cl. 6667, 6387, 6318,
6976, 6769, 6935,
6373, 6375.



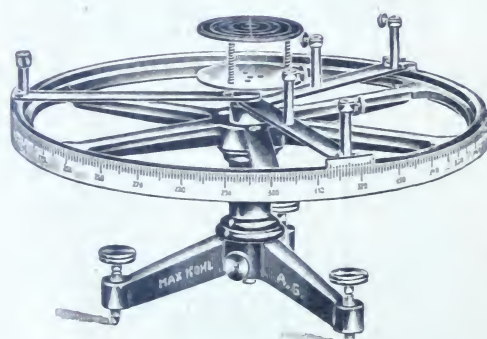
82824 A.



82824 B.



82824 C.



82825. 1:8.



53818. 1:8.

82824. Spherical Concave Mirror, Figure (Model in the Deutsche Museum, Munich), for generating Real Images

Fig. 82824 A shows a photograph of the reduced real image of the small porcelain figure as it appears, inverted, in front of the concave mirror, this figure having been set up as shown in Fig. 82824 B, outside the focus of the mirror. Fig. 82824 C shows the figure set up within the focal length of the mirror, so that a virtual, magnified and erect image appears in the mirror.

£ s. d.
Price on
demand.

82825. Goniometer (Noack's), Figure, of metal with circle 40 cm diameter graduated in degrees, and with three movable arms (which can be clamped in place) having verniers for reading from $\frac{1}{10}^{\circ}$, adjustable stage, telescope, linear source of light, collimator lens

6. 5. 0

82825a. 3 Rollers, Ring, Thread and Pin, for above, for the experiments on the parallelogram of forces (Noack, Aufg., p. 24)

1. 0. 0

82825b. Optical Accessories for above

1. 5. 0

82825c. Spectrum Device, comprising achromatic telescope, slit-tube and scale-tube, with lighting arrangements

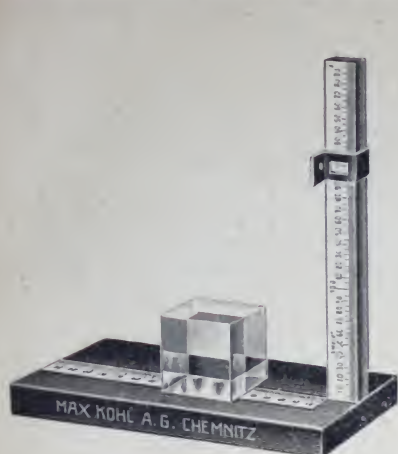
4. 10. 0

53818. Goniometer and Spectrum Apparatus for School Use, after Grimsehl, Figure (Ztschr. f. d. phys. u. chem. U. 17, 1904, p. 207). Description

2. 8. 0

The two flat iron bars are connected by a hinge formed of four pieces of flat brass, which can be rotated by 4 universal-joints having hollow axes. One axis (A) is placed exactly along the line of continuation of the inside side surfaces of the iron bars, and this axis carries the centrally fixed pin of the object-table. The opposite axis (C) always moves along the bisecting line of the angle formed by the iron bars. The object table or stage has an attachment fitted with a longitudinal slit. By means of a steel pin passing through the slot into the hollow axis C the object-table is guided so that when the apparatus is used as a spectroscope, the prism placed on the table always remains in a symmetrical position when the arms are turned. When using the apparatus as a reflex goniometer, the steel pin is passed through the slot and into one of the hollow axes in the arms, so that the position of the object table always remains unaltered relatively to the particular arm. In goniometrical measurements, the attachment is used as a handle to turn the object-table.

Cl. 7374, 7370,
7371,
6263, 6306.



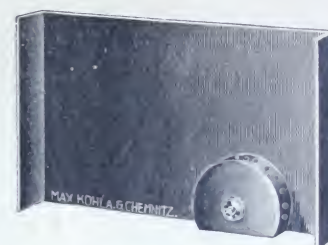
82827. 1:7.



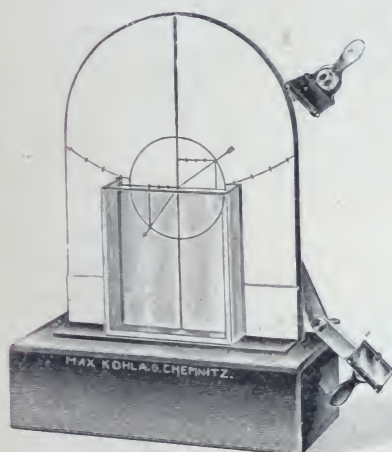
53845. 1:9.



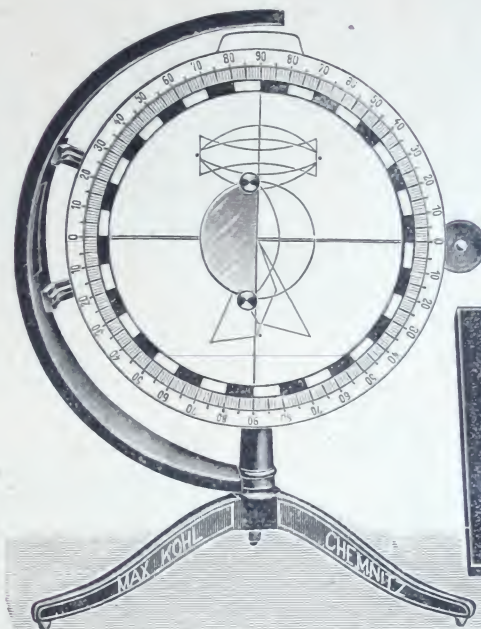
53838. 1:12.



53844. 1:7.



82828. 1:7.



53859A. 1:6.



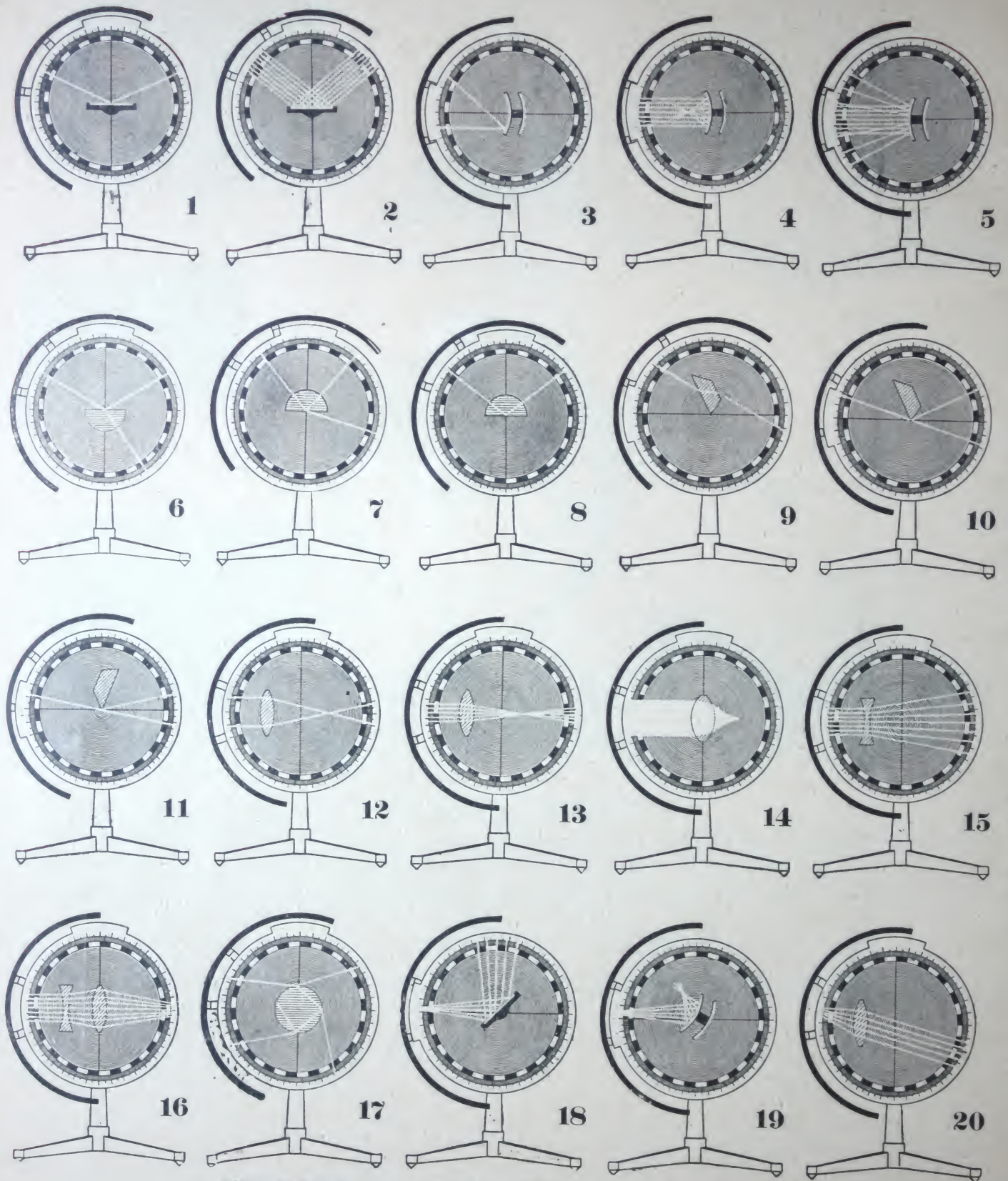
Refraction, Total Reflection.

82827. **Measuring Board with Diopter and Glass Cube**, Figure (Ztschr. f. d. phys. u. chem. U. 15, 1902, p. 199), for determining the refractive indices of glass £ s. d.
1. 2. 8
53838. **Rectangular Glass Box for Experiments on Refraction and Total Reflection** (W. D., Fig. 277—283 [263—269]), and for the **curvilinear propagation of light** (W. D., p. 337 [310]), 30 cm long, 7.5 cm wide and 18 cm high, Figure, for use in association with the apparatus No. 53844 and 53845 0. 18. 0
53844. **Refraction and Reflection Apparatus**, after Weinhold (W. D., Figs. 284, 285), casting the luminous rays in all directions, **without** glass vessel, Figure; the glass vessel can be used as No. 53838 0. 16. 0
53845. — *idem*, after Grimsehl (Ztschr. f. d. phys. u. chem. U. 20, 1907, p. 214), with glass vessel, Figure, **Description** 1. 2. 0
The apparatus can be used with the room half darkened. An arc lamp should be employed as the luminous source.
82828. **Ponomarenko's Optical Apparatus**, after Ponomarenko, Figure, for explaining the laws of the refraction of light. **Description** 4. 0. 0
53859. **Optical Disc** after Hartl, Figures A and B (Nos. 1—4), for demonstrating the laws of elementary optics (Ztschr. f. d. phys. u. chem. U. 9, 1896, p. 113; M.T., Fig. 134), for experiments with **single rays** and **parallel rays**, **Description** 3. 18. 0

The apparatus is used in an undarkened room with direct sunlight; the entire arrangements is very comprehensive. The following can be demonstrated: the **Law of Reflection** for Plane Mirrors; the effects and laws relative to the concave and convex mirror; **Refraction** by a plane parallel plate; prismatic refraction and **chromatic aberration**; the action of **condensing** and **dispersion lenses**; explanation of the **rainbow**.

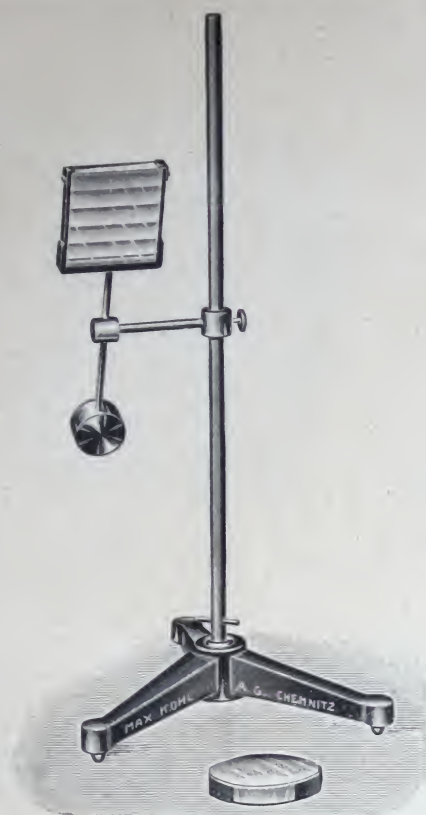
The following pertain to the apparatus: 2 **Slotted Sheets** with three and seven gaps; **Coloured Glass Plates** and **small Brass Plates**; 1 **Glass Plane Mirror**; 1 Concave and 1 Convex Mirror, of glass; 1 each semi-circular, circular, and trapezoidal Crystal Plate; 1 Bi-convex and Bi-concave Cylindrical Lens of crystal glass, also a rectangular prism with members of equal length.

Cl. 6779, 7183, 6866,
6894,
6333, 3637.

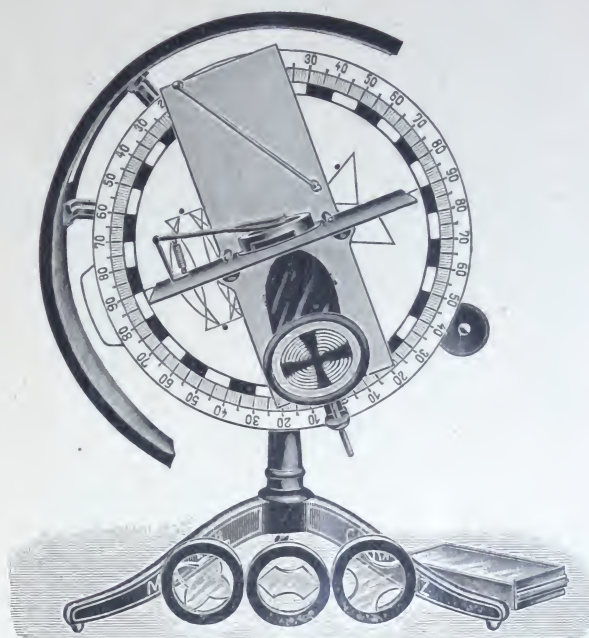


53.859 B, 53.860. 1:11. Demonstrations with the Hartl Optical Disc.

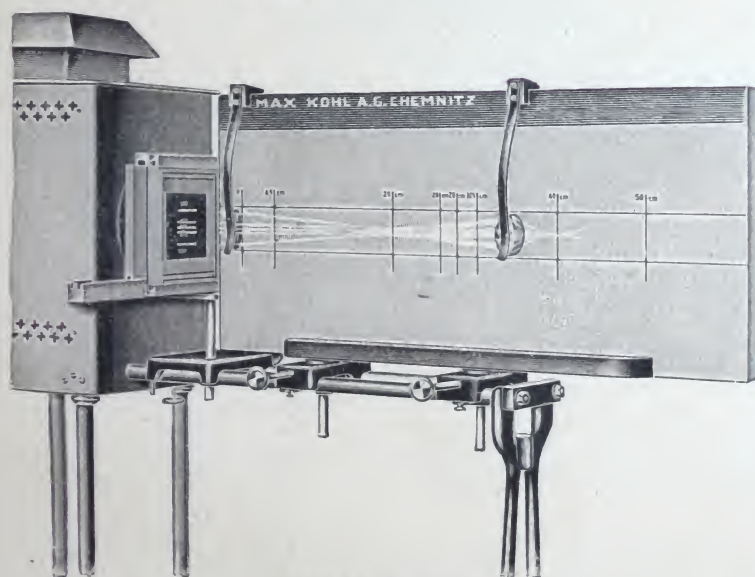
Fig. 53.589 B shows the path of the rays in the following experiments: 1. Reflection on plane surfaces; 2. Parallel Rays parallelly reflected; 3. Reflection on the Concave Mirror; 4. incident parallel Rays are reflected to the focus; after removing the slot diaphragm, demonstration of Catacautery; 5. corresponding Phenomena on the Convex Mirror; 6. Refraction and Reflection of Light between Air and Glass, determination of the refractive indices; 7. the same, between Glass and Air; 8. total Reflection in Glass; 9. Refraction in a plane Plate; 10. Refraction on the 45° prism; chromatic aberration; 11. minimum deflection with symmetrical Ray; 12. Refraction at condensing lens, focus; 13. collecting parallel Rays at the focus; 14. Diacauteury; 15. aberration of parallel Rays; 16. combination of Lenses; 17. explanation of the Rainbow; 18. Reflection of a central pencil of rays on a plane surface; 19. idem, on the concave Mirror; 20. central pencil of rays, rendered parallel.



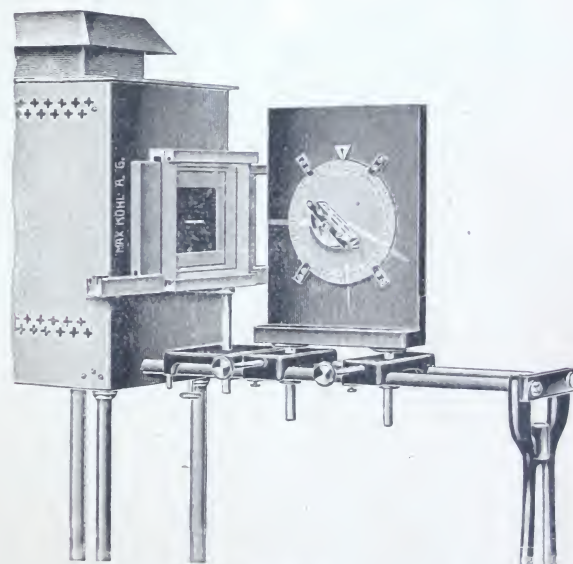
53 860 1:6.



53 862, 53 859, 53 863. 1:6.



82 829 A. Figure 1.



82 829 B.

- 53 860. **Addition to the Optical Disc, Figure**, for experiments with **central pencils of rays** (Ztschr. f. d. phys. u. chem. U. **10**, 1897, p. 236), see also Figure 53 859 B, Nos. 18—20 £ s. d.
1. 6. 0

Eight cones of rays, proceeding divergently from a point, are produced with this apparatus. The following can be demonstrated: the **Rule of the Image** for the Plane Mirror; the **Reflection** of the Luminous Rays issuing from a point, on Concave and Convex Mirrors; existence of the **real Image**; **Refraction** by a Condensing Lens or Aberrating Lens of the Rays issuing from one point; Action of **Spectacles**; Action of Diaphragms.

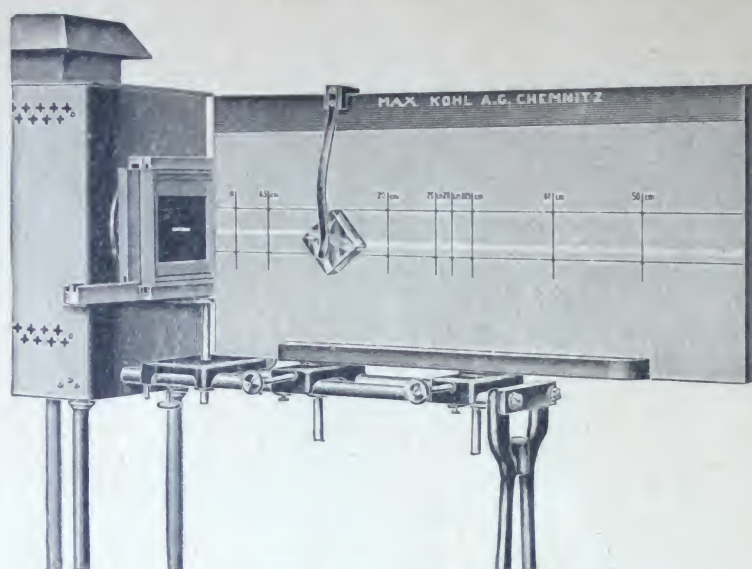
The additional apparatus consists of a separate ground **crystal plate** on iron stand, one bi-convex **crystal glass lens** and one **diaphragm**.

- 53 862. **Polarisation Apparatus** for placing on the Hartl Optical Disc, Figure (Ztschr. f. d. phys. u. chem. U. **19**, 1906, p. 105), without glass preparations 2. 8. 0

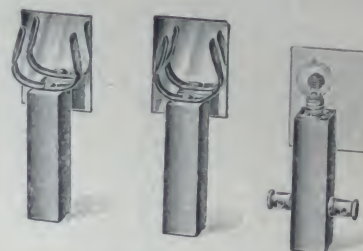
The following can be shown: uniform **reflection** of ordinary unpolarised Light; **Polarisation by Reflection**; **Polarisation by repeated Refraction**; **chromatic Polarisation**; **Phenomena in converging, Polarised Light**.

The apparatus consists of 1 rectangular **Sheet Iron Plate** fixed on the optical disc; 1 plate glass **Slab** and 1 set glass **Plates** as interchangeable **Polarisers**; 1 rotary **black plate glass Slab** as **Analyser**; 1 **Stage** arranged between the former; 1 small **Projection Screen**; 1 **Condensing Lens** for producing converging Light and 1 **Sheet Iron Screen** for completely shadowing the Projection Screen.

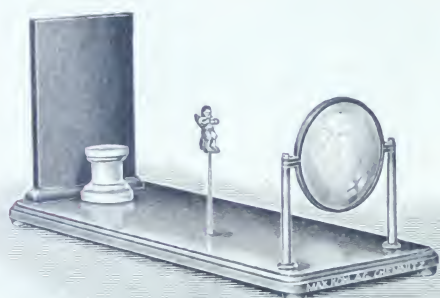
Fig. 53 862 shows the image when using an uniaxial crystal of sodium nitrate.



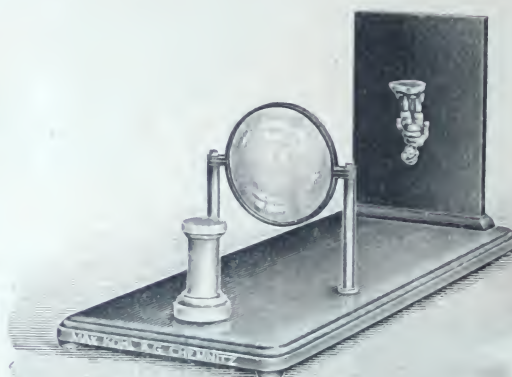
82829A. Figure 2.



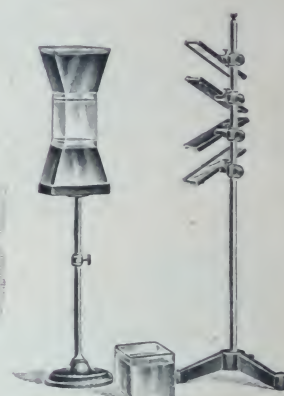
53932c. 1:4.



82830A.



82830B.



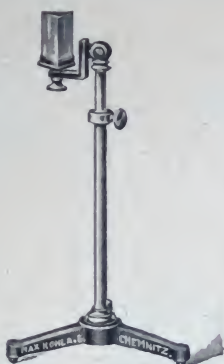
53889. 1:10.

- 82829A. **Universal Optical Apparatus for the Projection Lantern** after Rosenberg, Figs. 1 and 2, with accessories; for demonstrating the laws of reflection and refraction in mirrors, lenses, and prisms, for demonstrating the resolution of white light into the spectrum colours and their recombination, the path of the rays in the microscope and telescope, etc. £ s. d.
7. 14. 0
- The apparatus consists of a wood board covered with white paper, and attached to the optical bench. The lenses, prisms mirrors, etc. supplied can easily and quickly be fixed by suitable clamps. The slits are inserted in the frame of the diapositive (lantern slide) holder. Fig. 1 on p. 1445 explains the path of the rays in the astronomical telescope. The condenser is inserted and the arc lamp adjusted so that the light emerges parallel from the slits. It then falls on the wood board and here clearly shows the direction of travel. Fig. 2 shows the refraction of light in a plane-parallel glass plate.
- 82829B. **Light Refraction Apparatus** for above, Figure on p. 1445 1. 15. 0
53889. **Built-up Model of a Convex Lens and of a Concave Lens (Polyprism)**, after Grimsehl, for demonstrating the path of the rays (Ztschr. f. d. phys. u. chem. U. 20, 1907, p. 215), consisting of two parallelepipedic glass vessels for filling with water, two similar vessels of trapezoidal section, which can be built up together into lenticular bodies; 1 table stand for same and 1 stand with 4 mirrors for conducting the luminous rays, Figure 2. 14. 0
- 53932b. **30 Lenses**, arranged in dioptries, in box, for use with preceding apparatus and with apparatus for determining focal length, No. 53932c, and the Grimsehl Diffraction Apparatus No. 54549, after Grimsehl, etc., Figure on p. 1447 1. 10. 0
- 53932c. **2 Glow Lamp Holders and 1 Lens Mount** on wood pillar, with glow lamps and measuring rod, after Grimsehl, for determining the **focal length** of convex lenses and of concave lenses in **practical school work** (E. Grimsehl, Ausgewählte physikal. Schülerübungen, Figs. 23—26), Figure 0. 12. 0
- 82830A. **Bi-Convex Lens for Explaining the Position and Magnitude of Lens Images**, Figure. This is a copy of the model in the Deutsche Museum at Munich 3. 0. 0
- 82830B. — idem, different Pattern, Figure 3. 0. 0

Fig. 82828 A shows the small porcelain figure set up within the focus of the lens. A magnified erect and apparent image appears behind the figure on the socket on the same side of the lens. Fig. 82828 B shows the arrangement when the figure is outside the focus of the lens, so that a small, inverted virtual image appears on the support on the other side of the lens.



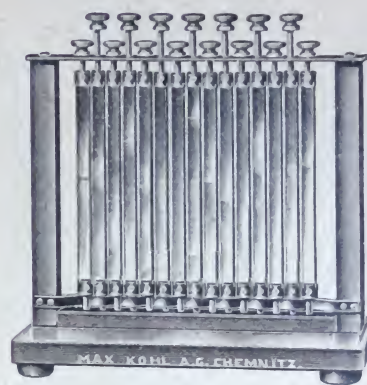
53 932b. 1:4.



53 988/94. 1:8.



54 004.



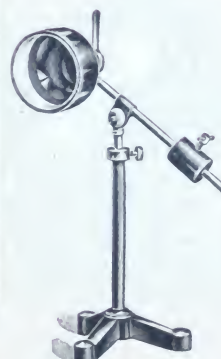
54 075. 1:5.



54 032. 1:7.



54 069. 1:9.



Spectrum Analysis and Synthesis.

Prism Stands, with height adjustment, cf. Figures 53 988—94; the prisms can be rotated about two horizontal axes perpendicular to each other. £ s. d.

List No.	53 988	53 989	53 990	53 991	53 992	53 993	53 994
Length of Side of Prism mm .	25	30	35	40	45	50	60
Without Prism £	0.18.0	0.18.0	1.0.0	1.0.0	1.4.0	1.4.0	1.10.0

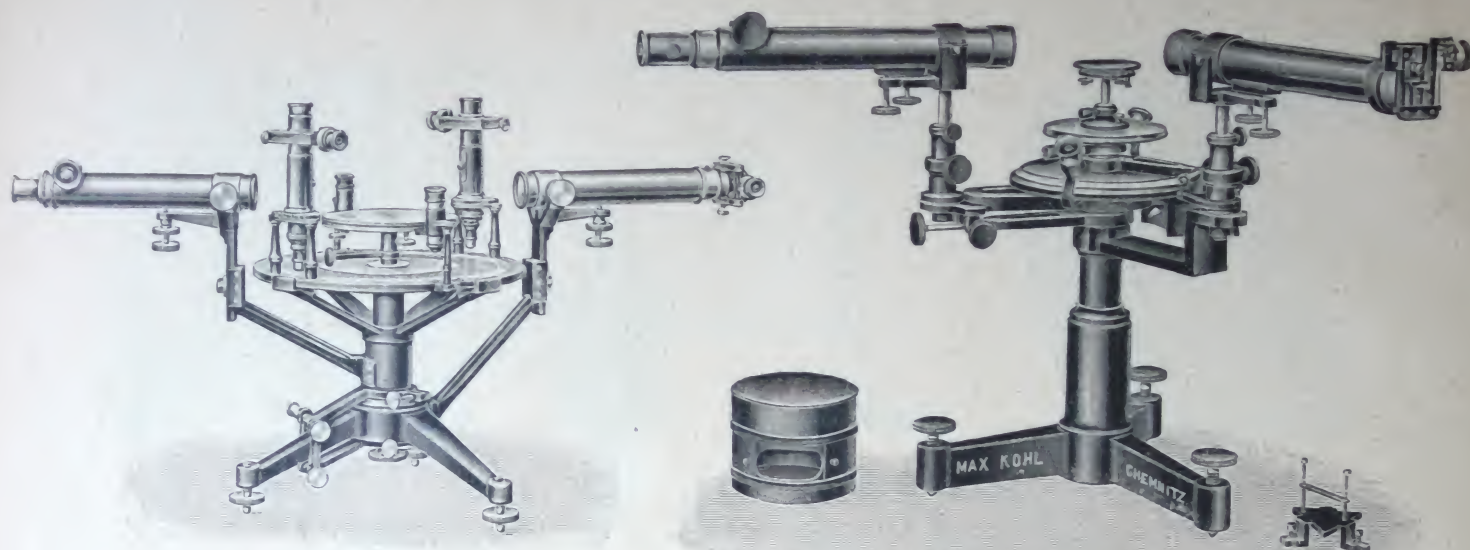
The preceding prices include the cementing in of the prisms if the latter are ordered at the same time as the Stands.

54 004. **Carbon Disulphide Prism**, flask form, Figure 0. 16. 0

54 032. **Gas Prism** after Biot and Arago, for determining the absolute coefficient of refraction of air and other gases, with barometer gauge, brass mount and stopcock, for setting up on the air-pump (Gan.-Atk. Fig. 536), Figure 3. 0. 0

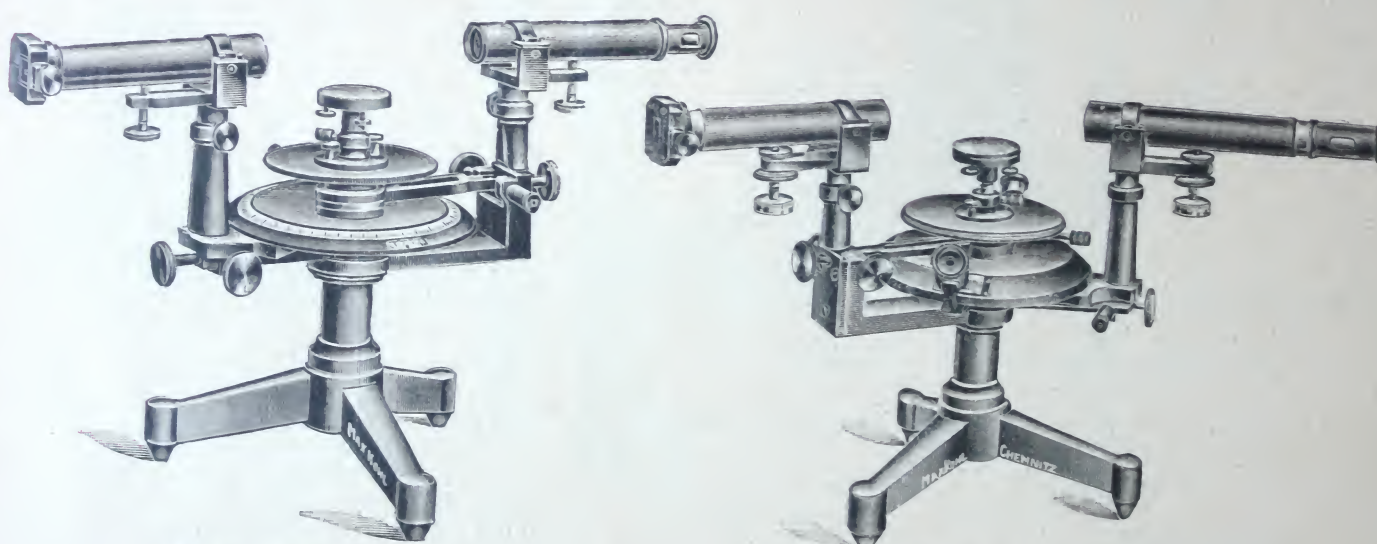
54 069. **Rainbow Apparatus** after Grimsehl (Ztschr. f. d. phys. u. chem. U. 20, 1907, p. 213), consisting of a glass vessel representing the rain-drop, on Stand, and a receiving screen with gap, Figure 2. 0. 0

54 075. **Laminated Mirror** after Oosting (Ztschr. f. d. phys. u. chem. U. 11, 1898, p. 132; M. T., p. 186), Figure 2. 10. 0



82 831. 1:10.

53 823 a. 1:6.



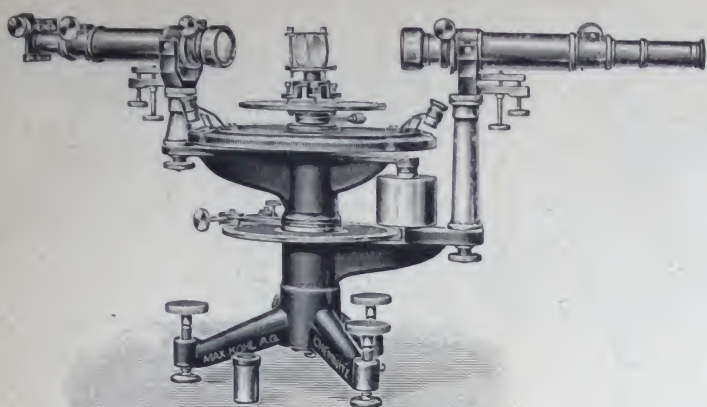
53 824 a (53 826 a). 1:5.

53 827 a. 1:5.

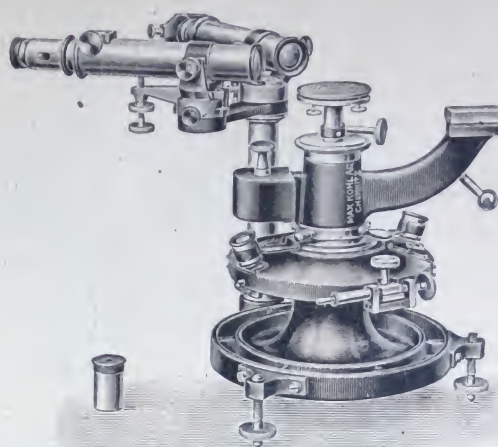
Spectrometers, Spectrum Apparatus, Spectrographs, Spectroscopes.

Victor von Lang's Spectrometers.

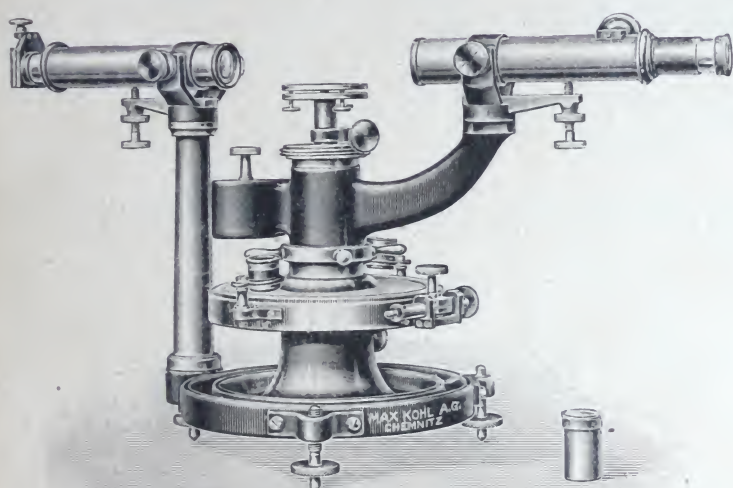
82 831. Spectrometer, Victor von Lang's, Figure, circle 324 mm diam., graduated on silver. The reading is made by two micrometer microscopes to 1 second. The telescopes have an objective aperture of 41 mm	£ s. d.
82 832. — idem, circle 270 mm diam., telescopes with 27 mm aperture of objective	81. 15. 0
53 823 a. — idem, can also be used as a Reflecting Goniometer, Figure, with circle 150 mm diameter, concealed, on silver, with reading by means of magnifying glass to 20 seconds; objective aperture 27 mm. Without Centering Apparatus	62. 10. 0
53 824 a. — idem, can also be used as a Reflecting Goniometer, with circle 150 mm diameter, graduated in $\frac{1}{3}^{\circ}$, with telescope having an objective aperture of 22 mm, with magnifying glass, reading to 30 seconds. Without Centering Apparatus	32. 0. 0
53 826 a. — idem, can also be used as a Reflecting Goniometer smaller; without magnifying glass reading, Figure, practical model for laboratories; telescope of 19 mm aperture, graduated in $\frac{1}{2}^{\circ}$ and with vernier for reading to 1 Minute	23. 0. 0
53 827 a. — idem, Figure, with concealed Divided Circle and 2 magnifiers for reading, without prism illustrated in figure	18. 0. 0
This pattern can be highly recommended as the graduation cannot be touched by the fingers.	21. 0. 0



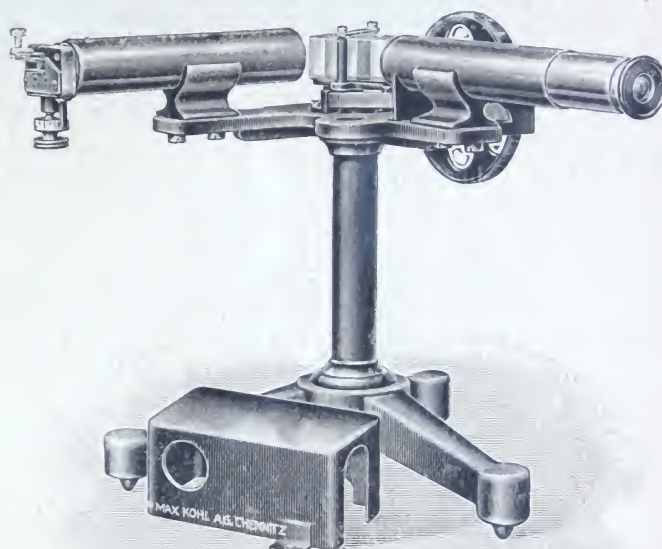
54081a. 1:9.



54083a. 1:7.



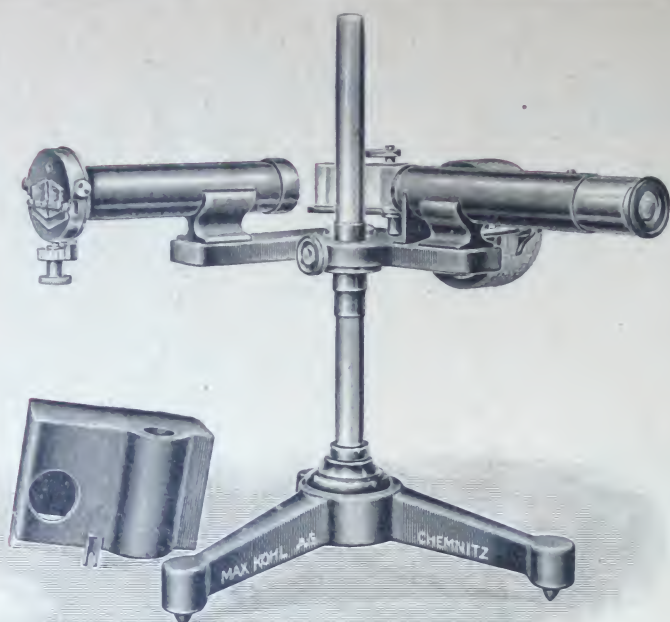
54084a. 1:6.



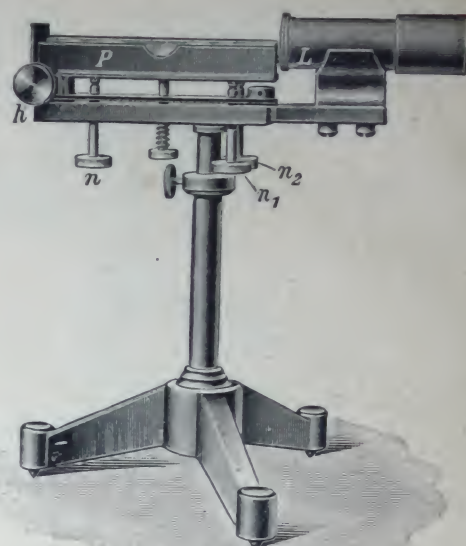
82833. 1:5.

Spectrometers, Monochromators and Spectrum Apparatus.

	£	s.	d.
54081a. Spectrometer after Bunsen, Figure, with fixed divided circle 270 mm diameter	60.	0	0
The circle is divided in $\frac{1}{6}^\circ$, the vernier reading gives 10". The objectives have a focal length of 325 mm and aperture of 33.5 mm. The gap with comparison prism opens symmetrically to the right and left. The apparatus has a rotary table for taking a number of prisms. Two oculars (one after Gauss) and a prism belong to the apparatus. The entire apparatus can be rotated about a vertical axis.			
54083a. Repeating Spectrometer , Figure, with two telescopes of 26 mm aperture and 234 mm focal length, with Gauss Ocular, with concealed circle and arrangement for carrying out goniometric measurements by Wollaston's method	60.	0	0
The circle is divided in $\frac{1}{4}^\circ$ on silver and permits of readings by a magnifying glass and two verniers to 20". Fig. A shows the instrument set up for use as a spectrometer, and Fig. B for use as a goniometer.			
54084a. — idem, without concealed graduated circle or arrangement to permit of goniometric measurements being made by Wollaston's method	47.	10	0
A Gauss Ocular is given in for goniometric measurements.			
82833. Spectrometer with wave Length Reading and fixed Deflection , Figure. This is a spectrometer for making chemical analyses with the aid of the absorption and emission spectra	24.	0	0
The apparatus is provided with a 90° constant deflection prism (Abbé's) the dispersion of which in conjunction with the magnification given by the telescope is sufficient to split up the Na-line sharply into its two components. The wavelengths are read off direct on a 10 cm. diam graduated drum covering the range from about 430μ to 720μ . The focal length of the telescope objective is 160 mm.; useful aperture of the telescope objective = 20 mm.; magnification of the reading telescope + 8. The length of the spectrum in the image plane of the telescope between C and F = 7 mm.			
82833a. Symmetrical Micrometer Slit , enabling the spectrometer to be used also as a monochromator by inserting the slit in the telescope instead of the observing eye-piece. Reading to 0,05 millimetre	4.	16	0



82834.



82837.

82833b. **Achromatic Projection Lens in Tubular Mount**, for projecting the homogeneous spectrum zone emerging from the slit on to or into the apparatus. This lens can be placed on the slit and is capable of adjustment

Two marks, designated 1:00 and 1:1 show the proper positions for the lens. In the first position (1:00) the projection lens is distant from the emergent slit by its focal length and generates a fairly parallel pencil of rays; whereas at the position marked (1:1), the emergent slit is 20 cm. distant.

82834. **Spectrometer with Wave Length Reading and Constant Deflection**, greatly improved design, Figure

The wave-length drum, of very neat design and easy to read, is 8 cm. diam., and the immergent gap is fitted with a graduated drum for reading the width of gap (0.05 mm.), with stand having up-and-down adjustment. Prism with constant deflection of 90° (Abbe's). Accuracy of adjustment (average) = 0.2μ . With Ramsden eyepiece 20 mm. focal length with adjustable crosswires. Focal length of the telescope objectives = 160 mm.; ratio of aperture = 1:7; magnification of telescope = 8; length of spectrum between C—F in the image-plane of telescope = 10 mm.

82835. — idem, with ratio of aperture = 1:5, hence giving greater luminosity, and fitted with larger prism

82836. — idem, focal length of telescope objectives = 210 mm. ratio of aperture = 1:7; magnification of telescope, 10.5; length of spectrum in the image-plane of telescope = 13.25 mm

82837. **Lummer-Gehrke Plate in Mount on Stand, with Achromatic Lens**, Figure. By adding a Lummer-Gehrke plate any spectroscope, and especially those listed above, can be converted into a **Spectrum Apparatus of high resolving power**. Spectrometers 82833—82836

Length of the plate, about 130 mm.; width of plate, 15 mm.; thickness of plate, $4\frac{1}{2}$ mm.; resolving capacity = 20000. The rays proceeding from the source of light, after passing through a condenser lens, pass through the plate. The achromatic lens L then generates in its image-plane the refracted image consisting of a number of partial images, superposed, and corresponding to the different individual colours of the source of light used. The spectrometer is set up so that the **diffracted image** of the lens L falls on the perpendicular gap.

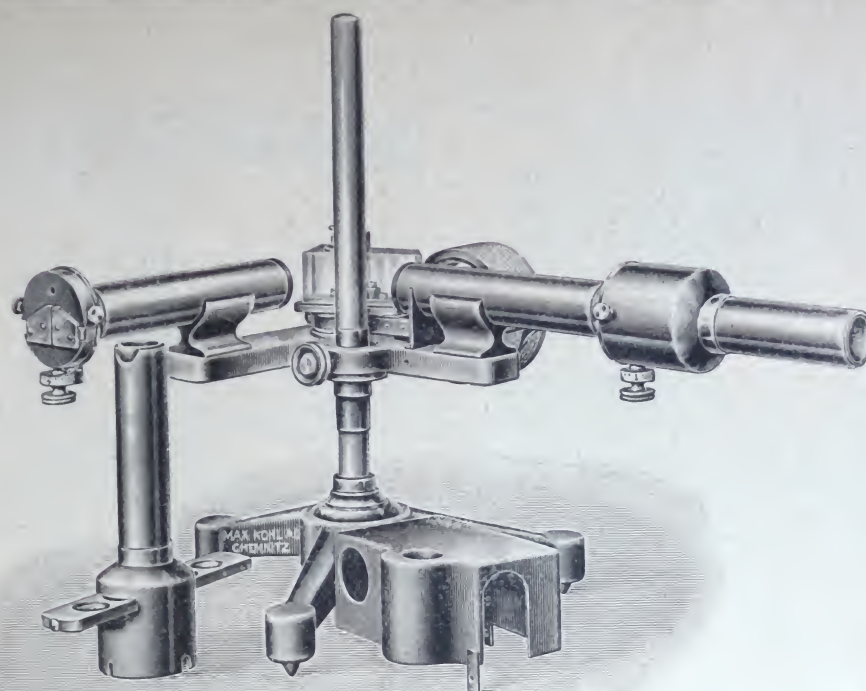
Monochromators, Figure on p. 1451, design exactly the same as the spectrometers listed under Nos. 82834—82836 only instead of the observation eyepiece there is an **Emergent Gap**.

Both gaps are symmetrical and fitted with **divided drum for measuring the width of gap**. Behind the emergent gap is a **chromatic projection lens in tubular mount** (No. 82832b) and a microscope for focussing the region of the spectrum used for illumination, and for controlling this adjustment. This microscope can be cut out after being used, by withdrawing it from the path of the rays.

List No.	Focal Length of Objective mm	Ratio of Aperture	Portion of Spectrum with an aperture of emergent gap of 0.5 mm with the lenses	Length of Spectrum between C—F in the image-plane of the emergent tube	Price £ s. d.
82838	160	1:7	{ C = 13μ F = 5μ } { D = 10μ G = 3μ }	10 mm	44.12.0
82839	160	1:5		10 mm	54. 5.0
82840	210	1:7	{ C = $8-9\mu$ F = 3.5μ } { D = $6-7\mu$ G = 2μ }	13.25 mm	56. 0.0

82841. **Achromatic Lighting Lens**, in tube, for inserting on the immergent gap

82842. **Stand Device** to enable the Monochromator to be used in a vertical position as well; with large total reflection prism for inserting on the **achromatic illuminating lens**



82838—82840.

- 82 844. **Ultra-Violet Monochromator with Wave-Length Reading.** Wave-length drum T_1 , 8 cm diam., the objectives being positively controlled at the same time by rack and pinion motion. The focus of the objectives is read off on a second wave-length drum T_2 £ s. d.
62. 10 0

With a view to eliminating disturbing reflections, tubes are avoided for the immergent and emergent gaps. All extraneous light and other effects are obviated by a cap which slips over the entire apparatus and is kept in place by a few small screws. The gap is symmetrical and the apparatus has a graduated drum for measuring the width of gap (reading to 0.05 mm.). Straubel quartz prism with constant deflection of 90° . Range $500\mu\mu - 200\mu\mu$. Average accuracy of measurement = $1-2\mu$.

Homogeneous in the Various Ranges of Spectrum

	At $500\mu\mu$	At $200\mu\mu$	Spectrum Range $\mu\mu$	Portion of Spectrum with 0.3 mm opening of Gap (in $\mu\mu$)
Focal Length of objectives	160 mm	130 mm		
Ratio of Aperture	1:5.2	1:4.5		
Dispersion between $500\mu\mu$ and $200\mu\mu$: $9^\circ 45'$.				
			Hg { 404.6	17
			365	9
			312.5	5.5
			253.6	3
			Cd 214	1

For lighting the apparatus, a sliding quartz tube is used which is placed inside a tube set up behind the gap. Outside, the tube has two scales which give the position of the lens for the wave-lengths 200, 250, 300, 400 and $500\mu\mu$ for the following cases:

- for parallel emergent light ($1:00$),
- for casting the image of the emergent gap in a plane 200 mm. distant from the gap itself.

- 82 845. **Universal Monochromator with Wave-Length Setting for the entire visible and ultra-violet Range** from $200\mu\mu - 750\mu\mu$ £ s. d.
75. 10 0

With Quartz Double Prism (Straubel) for the ultraviolet range and Abbé Flint Prism with a constant deflection of 90° for the visible range, both prisms being interchangeable. The Objectives used in both cases are quartz lenses, being positively controlled by rack and pinion movement. The optical data are the same as for apparatus Nos. 82 838—82 840, 82 844.

- 82 846. **Universal Monochromator for the whole of the visible and ultra-violet Range** from $200\mu\mu - 750\mu\mu$; as suggested by Prof. Dr. Thiel, Figure, on p. 1452 £ s. d.
41. 4 0

With Quartz Object Glasses in each case, the objectives being adjusted positively and simultaneously by rack and pinion movement, but each adjustable independently by a movement having large drum containing the wave-length scale. With large divided circle 15 cm. diameter graduated in whole degrees, and with two symmetrical gaps with measuring drums, without Prisms. The optical data are the same as in Nos. 82 838—82 840, 82 844.

- 82 846a. **Large Flint Glass Prism** for above, with mount £ s. d.
5. 7 0

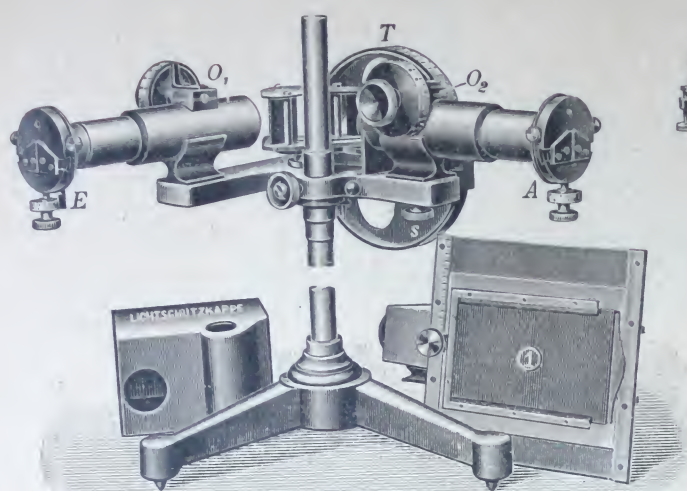
- 82 846b. **Large Quartz Double Prisms** (Straubel's), with mount £ s. d.
13. 15 0

Owing to the difficulty of obtaining optically pure quartz, firm prices can only be quoted on application.

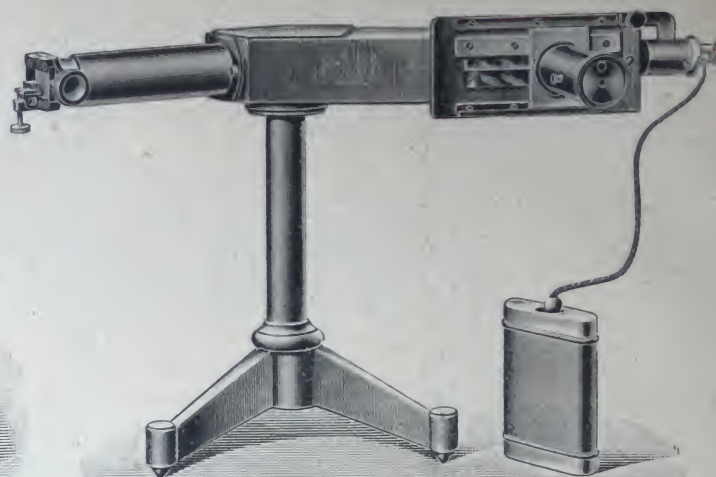
- 82 846c. **2 Short Optical Benches** for setting up the source of light, photo-electric cells, absorption vessels, etc. £ s. d.
1. 13 0

- 82 846d. **Riders** for the Optical Bench. Each £ s. d.
0. 12 4

- 82 846e. **Wood Base Plate** for setting up the pieces of apparatus Nos. 82 845—82 846d. £ s. d.
1. 2 0



82846.



82847.

82847. **Ultraviolet Spectrometer**, Figure, **Wave-Length Graduation** in one length of 50 mm, so that the last **Al-lines** 185,2 and 186 $\mu\mu$ are clearly visible. With two quartz prisms of 30° each arranged in Young's method with convex immergent and emergent surfaces, so that the prisms serve at the same time as objectives. The gap is symmetrical and fitted with divided drum

Behind the fluorescent plate, inclined obliquely to the axis of the lens and provided with wave-length scale, is placed the eyepiece which slides along the plane of the plate and is used for observations. Any other magnifying glass (watchmaker's glass) can be used for observations, which must always be made aslant from above. For lighting the wave-length scale a small 3,5 V. electric lamp is provided, this being fed from a small pocket battery. The lamp is fixed in a suitable mount on the frame of the fluorescent plate.

Table showing Nature of Graduations and Accuracy of Measurement.

Range of Spectrum $\mu\mu$	1 Scale-division = $\mu\mu$	Mean magnitude of a scale-division in mm
186—190	—	0,6
200—250	2	0,7
250—300	2	0,35
300—400	5	0,5
400—450	5	0,4

54090. **Echelon Grating** (Michelson's), Figure on p. 1453, for obtaining **high resolving power**, for use in conjunction with the spectrometers Nos. 82833—82836

54092a. **Spectrum Apparatus** with a **Rutherford Prism**, Figure on p. 1453

The observing telescope and gap-tube have an aperture of 30 mm and focal length of 312 mm. The telescope is a power 10 instrument; diameter of plate 180 mm; telescope focussed by micrometer screw; arc divided in $\frac{1}{12}^\circ$ with vernier, in one piece with the alidade of the telescope, permitting a reading of $12''$, by which the position of the lines in the spectrum is determined. Gap with micrometer screw and comparison prism. The dispersion from A—H₂ is 14° . The two D-lines are at an angle of $1' 36''$ to each other; the fine nickel line should be plainly visible between these when the instrument is correctly focussed.

54093a. — the same apparatus, with arrangement **for convenient reading** of the scale parts

A reading telescope is fixed above the observing telescope and parallel to the same. The former telescope has a right-angled prism at the end and brings to the vision of the observer by reflection the graduation of the divided arc and of the vernier.

54094a. **Spectrum Apparatus**, as No. 54092a but **smaller** pattern; observing telescope with aperture of 27 mm and focal length of 230 mm, power 8; a gap-tube of the same dimensions; with brass plate on which both tubes are mounted, of 155 mm diameter; graduated arc divided in $\frac{1}{6}^\circ$, vernier giving $30''$

54095a. **Spectrum Apparatus**, Figure on p. 1453. same size as No. 54092a, but instead of having a Rutherford Prism is fitted **with a 60° prism** constructed of extra heavy flint glass and with a dispersion of 7° . The position of the lines in the spectrum is in this case determined by a telescope with photographic scale instead of by divided circle. The observing tube can be adjusted by micrometer screw. Gap with micrometer screw and comparison prism . . .

£ s. d.

20. 15. 0

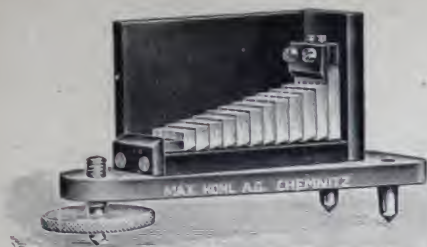
28. 10. 0

33. 10. 0

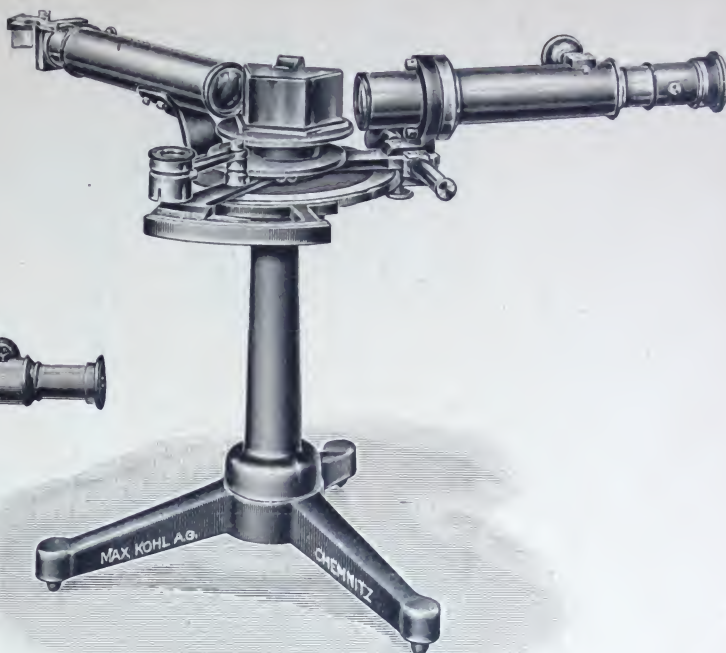
21. 10. 0

16. 0. 0

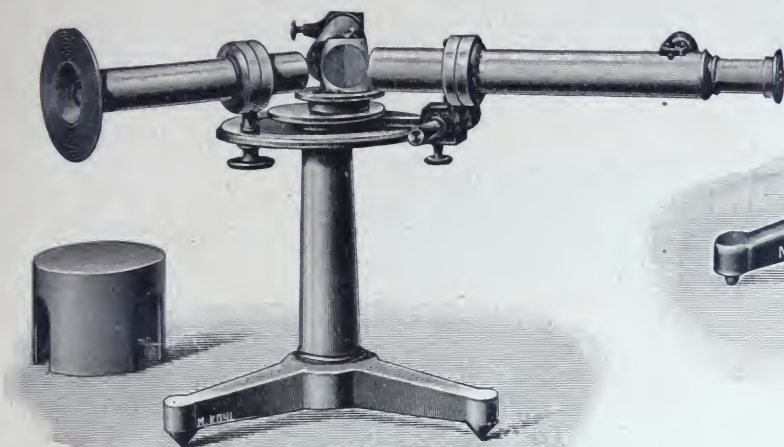
Max Kohl, Aktiengesellschaft, Chemnitz, Germany.



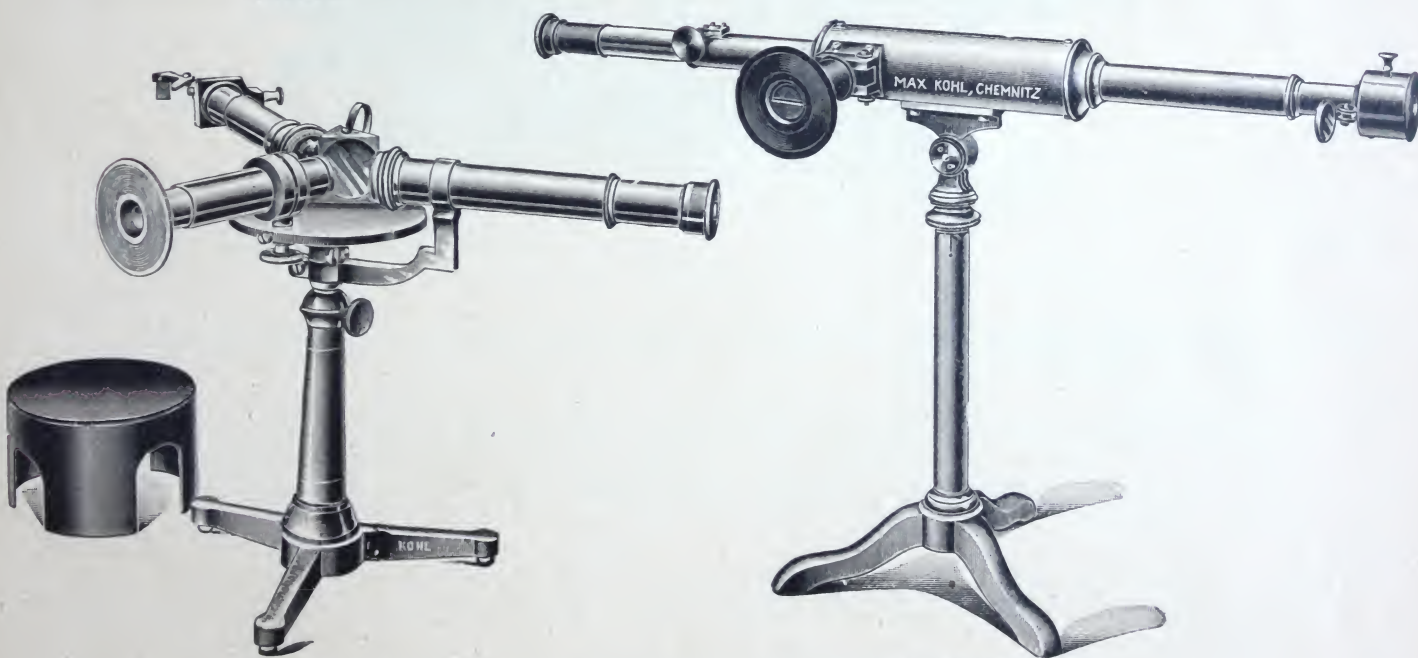
54090.



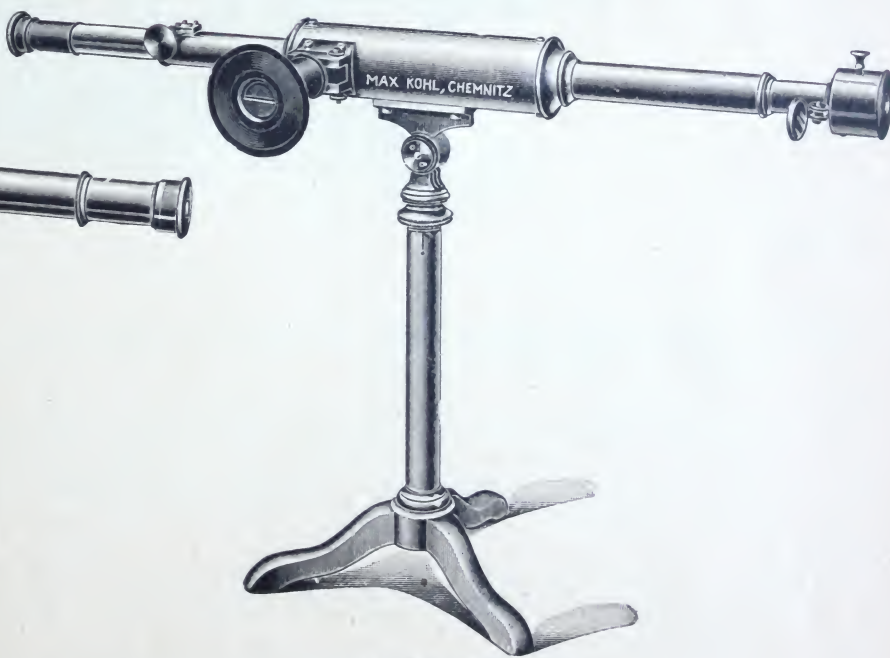
54092a.



54095a. 1:6.



54097. 1:5.



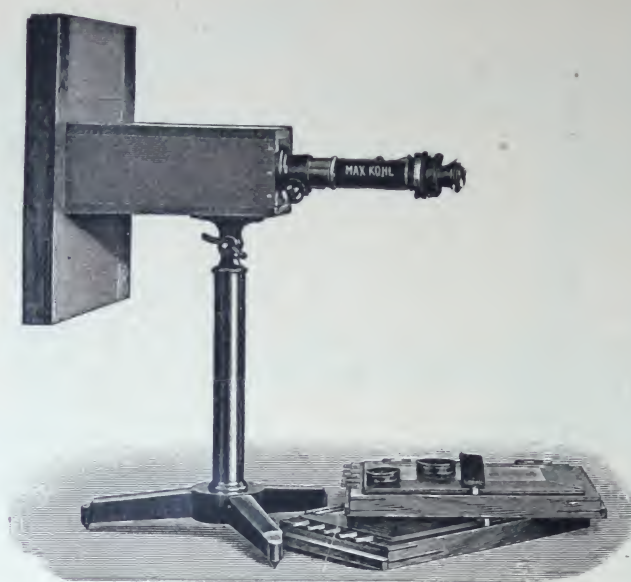
54101a. 1:6.

54096a. **Spectrum Apparatus** with observing telescope and gap-tube of 27 mm aperture and 230 mm focal length, with the scale telescope mounted on a brass plate 135 mm in diameter; observing tube without rack or micrometer screw; gap with micrometer screw and comparison prism £ s. d.
9. 0.0

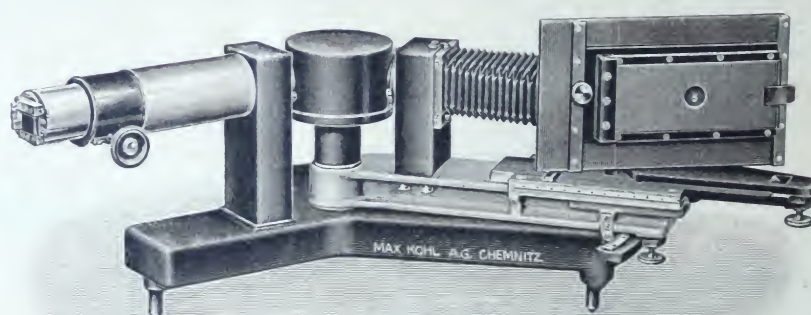
This apparatus is very efficient in spite of its low price; externally it resembles very closely Fig. 54095a.

54097. **School Spectrum Apparatus, Figure, Description** 4.10.0

The apparatus has a 60° prism constructed of medium-heavy flint glass and fitted on a brass plate 92 mm diameter on which is mounted the telescope, with scale. The observing telescope and gap tube are placed on the two arms, rotating on a trunnion, and situated underneath the plate. The arm carrying the observing telescope is movable and can be firmly clamped in any position in order to observe the spectrum conveniently. The observing telescope and gap tube have an aperture of 20 mm, a focal length of 150 mm, and a magnification of 5. The gap has a micrometer screw and, for the purposes of better demonstration, a **Comparison Prism** which can be switched out of operation. Dispersion 4°. The stand has height adjustment.



54100a. 1:7.



82848.

- 54101a. **Direct-vision Spectroscope** after Janssen-Hofmann, Figure on p. 1453 (Fr. phys. Techn. II, 2, Fig. 2818 [II, 904]) £ s. d.
20. 0.0

Observing telescope and gap-tube with 22 mm aperture, 182 mm focal length and approx. power 7. Gap with micrometer screw and comparison prism. On the middle cylindrical portion, in which the prism-system is fixed, a telescope with photographic scale is arranged laterally. The movement of the observing tube is carried out by a micrometer screw with a view to controlling the very extended spectrum, while focussing is carried out by rack and pinion. The apparatus is mounted on a stand having universal motion. Dispersion from A - H¹, approx. 9°.

- 54102a. — idem, with two prism-systems and twice the dispersion (approx. 18°) 22. 0.0

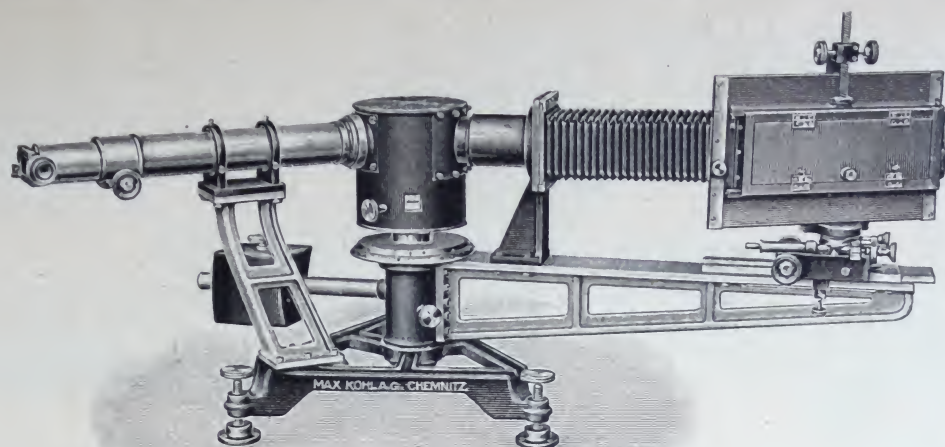
Spectrographs, Wave-length Grating Spectrometers.

- 54100a. **Spectrograph**, Figure, consisting of a Spectroscope combined with a Photographic Camera 13×18 cm 15. 0.0

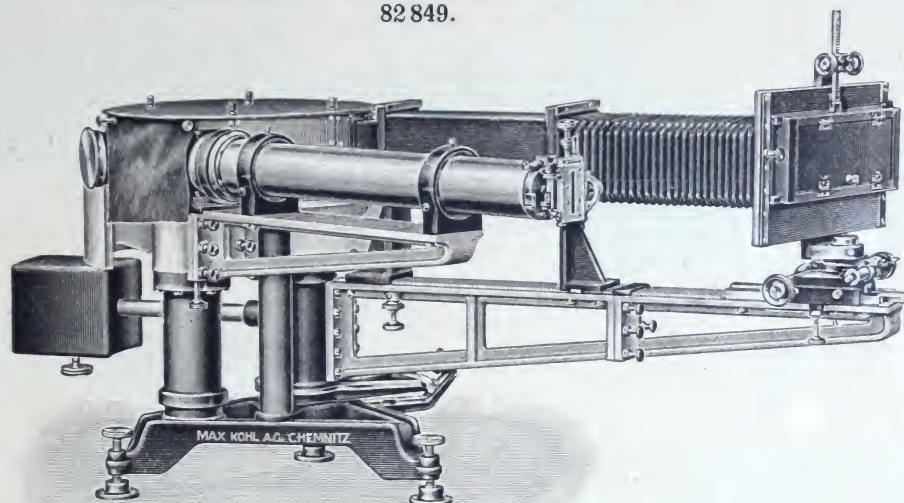
The spectrograph contains 1 quintuple direct-vision prism, 1 triple collimator objective of 20 mm aperture, 1 single micrometer gap slider with divided drum. The camera can be rotated in the vertical plane and a rack is provided for sharp focussing. The ground glass disc and the dark slide can be displaced vertically so as to admit of 5 exposures being made on one plate. The apparatus is specially suitable for investigating colour-sensitive plates and for teaching purposes.

82848. **Quartz Spectrograph** (Steinheil's), Figure, with simple unsymmetrical gap, collimator with long rack and pinion, capable of setting to all wave-lengths 35. 0.0

Camera on pivoting arm with divided circle and index and with following movements by hand: Focussing by sliding the camera, with millimetre reading. Tilting movement with reading in degrees. Height adjustment for the plate-holder, with mm-scale. Objective aperture of collimator and camera, 20 mm. Focal length, 240 mm for $n = 1.59$, brightness factor 1:12. The collimator lens is a simple spherically corrected lens, the camera objective a double "Spectroplan", which, with the collimator and prism together gives a flattened spectrum. There are two Young type prisms.



82849.



82850.

82849. Quartz Spectrograph (Steinheil's), Figure, complete type

£ s. d.
89.10.0

Objective aperture (a) of the collimator = 40 mm, (b) of camera = 45 mm. Focal length = 400 mm for $n = 1.59$, hence aperture ratio = 1:10. The collimator is a single spherically-corrected lens, the camera objective a double "Spectroplan", which, together with the collimator lens and prism flattens the spectrum.

With simple, dissymmetrical precision gap with quartz comparison prism, collimator with sufficiently long movement, so as to set the apparatus to any wave-length up to infinity; 1 Cornu prism 40 mm height and 50 mm side on pivoting prism table with divided circle; camera on pivoting arm, with clamp with graduated circle and vernier, and with following adjustments: Rack focussing with scale reading to 9.1 mm; camera tilt operated by measuring screw with drum reading; height adjustment for plate-slide by rack with millimetre scale, to enable any number of exposures to be made on one plate.

The photographic plate is focussed by shifting the position of the camera, so that the latter can be moved as close as possible to the prism, to enable the slanting pencil of rays to be photographed satisfactorily.

82850. Glass Spectrograph (Steinheil's), Figure

122.10.0

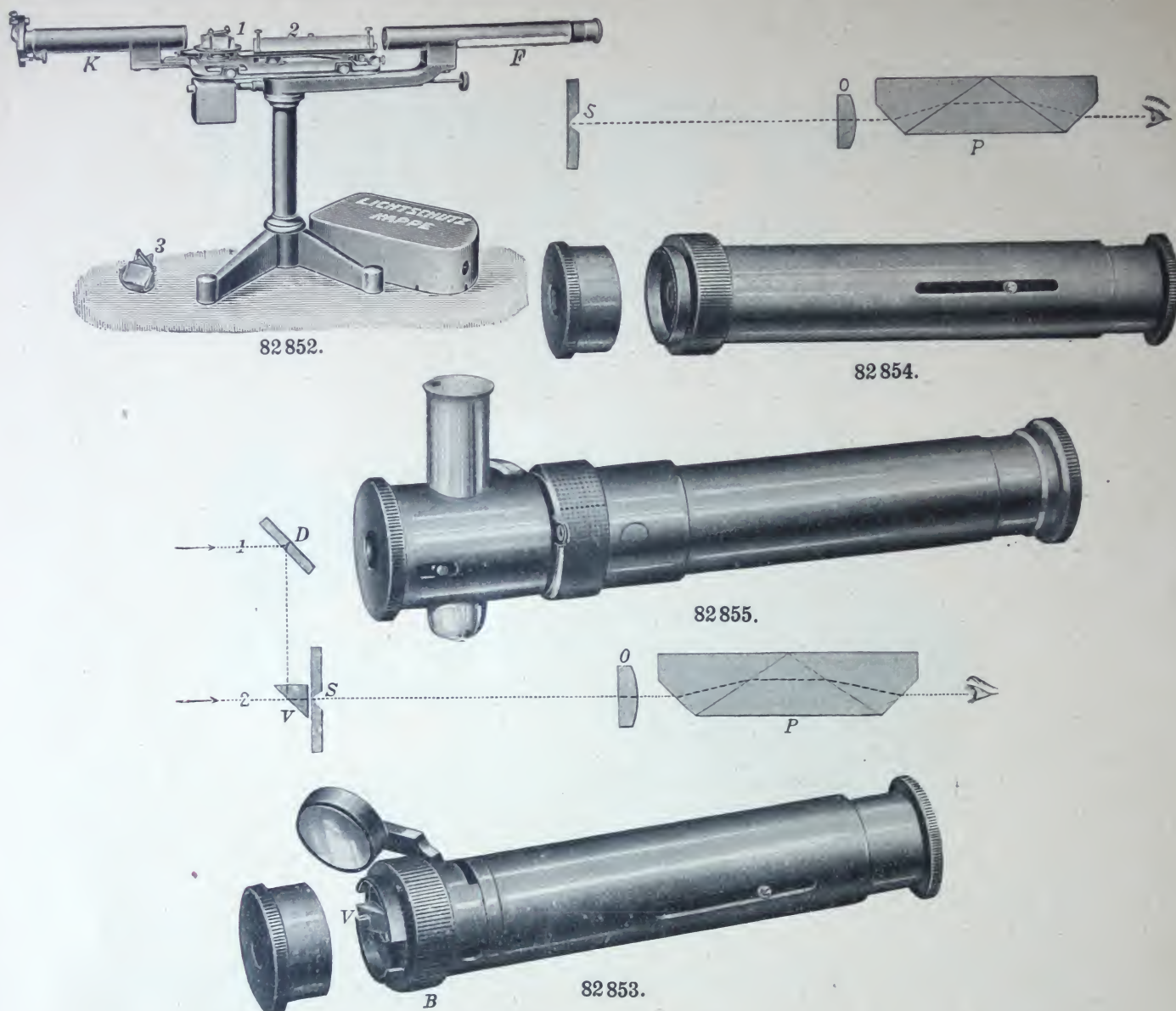
Objective apertures (a) of collimator = 45 mm, (b) of camera = 50 mm. Two different ratios of aperture may be used, viz., 1:3 and 1:10, that is to say, the camera objective (Spectroplan) has two focal lengths, viz. $f_1 = 135$ mm, and $f_2 = 450$ mm. With three 60° prisms, increasing towards the camera, and with condenser lens calculated for 1:3 but capable of being used for the other ratio. Since the apparatus can be used with either one or with three prisms for the two ratios of aperture, the choice of different spectra is thus provided. For 1:3 and 1:10 with three prisms the spectra are flattened. With a simple unsymmetrical precision gap with gap diaphragms or coincidence gap and protecting hood. The collimator is focussed by shifting the objective by means of a rotary ring. Prisms on pivoting prism stands with reading on divided circles. Camera on pivoting arm with scale and vernier and with following adjustments: Rack focussing and reading to 9.1 mm. Camera tilted by measuring screw reading on a drum. Height adjustment of the slide by rack with millimetre scale, so as to enable any convenient number of exposures to be made on a plate. Condenser with adjustment in all three directions. Convenient arrangements are fitted for adjusting all parts, while the apparatus can be easily dismantled for the various spectra, the adjustment previously set being maintained. With Gauss ocular capable of rotation about an axis in the image-plane and above the spectrum. In light-tight housing, easily detachable.

82851. Wavelength Grating Spectrometer, Cf. Figure 82834 on p. 1450 (Instead of the prism shown in that illustration, a diffraction grating is used)

45. 0.0

The grating, — a copy of the Rowland metal grating — is made on a 90° prism, and has a grating area of 30×30 mm, with about 15 000 lines to the inch. With a luminous source of sufficient strength, however, the accuracy attainable is more than twice that of a wave-length spectrometer made of the heaviest flint glass. The prism with grating is fixed to a stand in the same way as a constant-deflection prism, this table or stage being moved by an accurately calibrated screw with wave-length drum of 80 mm diameter having a spiral groove of $380 \mu\text{m} - 800 \mu\text{m}$. The objectives of the reading telescope and the gap-tube have a free aperture of 30 mm at about 200 mm focal length. The gap is symmetrical, with graduated drum for measuring the width of gap. The apparatus can be adjusted up and down so that the lowest position of the optical axis is about 16 cm, and the highest position about 35 cm above the surface of the stage.

Cl. 7406, 7404 82*



Spectroscopes.

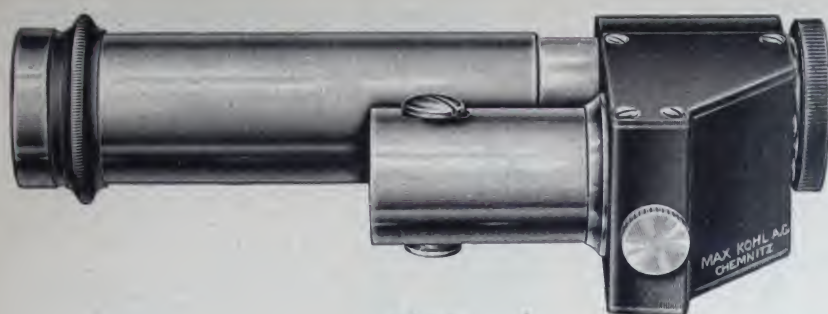
- 82 852. **Interference Spectroscope** (E. Gehrke's), Figure, with Lummer-Gehrke plate, for investigations into the spectrum lines and the Zeemann effect; with a resolving power = 100 000, so that $\frac{1}{100}$ of the D-lines can be resolved. Where the total reflecting prism 3 (Figure) is used, the apparatus can be used as an **ordinary Spectrum Apparatus** £ s. d.
22. 0.0

The best source of light to use is a mercury tube. K is the collimator with gap and collimator objective. The gap in this case is generally not vertical, but inclined at an angle of 45° to the vertical. The light passes into the constant-deflection glass prism 1 and, then passes through the plane-parallel glass plate 2. The emergent surface of 2 is ground on a bevel. The rays reflected many times inside 2, are combined in the image-plane of the observation telescope F, the phenomenon of interference being observed through an eye-piece of moderate magnification. The telescope F can be pivoted about the axis of the stand and clamped in position, and it also rotates about its own holder. A screw rotates the prism 1 so that various lines of the spectrum may be allowed in turn to pass through the field of view of F.

- 82 852a. **Arrangement for Observing the Zeemann Effect** with the Interference Spectroscope No. 82 852, consisting of: **Electro-magnet** on adjustable stand, together with a condenser lens 6.10.0
82 852b. **Spectrum Tube, Mercury-filled**, specially luminous 0.17.0
82 852c. **Wollaston Prism**, in mount, fitting the eyepiece of interference spectroscope No. 82 852 2.10.0

Hand and Pocket Spectroscopes.

- 82 853. **Pocket Spectroscope** with direct-vision prism P and comparison prism V, and a lighting mirror rotating about the axis of the spectroscope, Figure. In Box 2. 5.0
82 854. — **idem**, **without** comparison prism or lighting mirror D, Figure. In Box 2. 0.0
The achromatic objective O projects a virtual image of the gap S, the width of which is varied by the ring shown. Of this white, virtual image, the direct-vision triple prism P projects a series of coloured juxtaposed images — a spectrum. The cap serves to protect the gap
82 855. **Apparatus for Setting up Reagent Glasses**, including 6 reagent glasses, Figure, suitable for the foregoing spectroscopes Nos 82 853 and 82 854 0.10.0



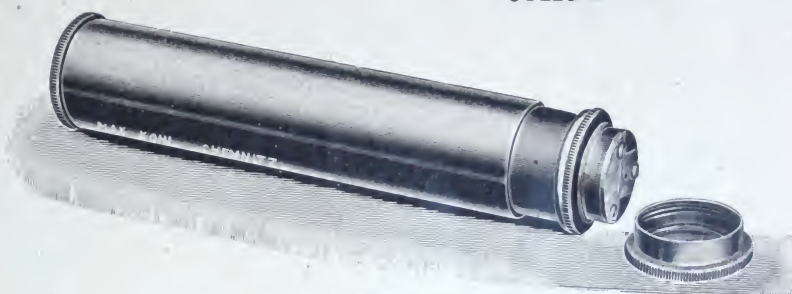
82856.



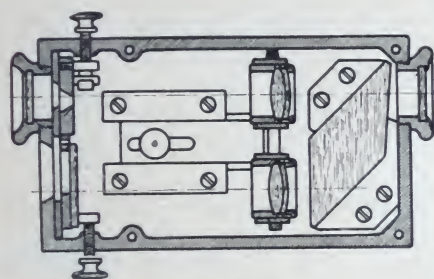
54116a. 1:4.



54119a. 1:4.



54117a. 2:3.



82858.



82857.

82856. **Pocket Spectroscope with Wave-Length Scale**, Figure, dispersion between C—F = 5°. With small box

£ s. d.
5.6.0

This spectroscope can also be used with pretty good success as a **local rain and weather forecaster**. Whereas, in clear sunshine and dry weather, the D-line shows up plainly without any subsidiary lines right and left of it, when a storm or rain is imminent, a second line, due to the presence of water-vapour, is visible at once on the red side of the D-line. This line will also exhibit slight dark shadows.

- 54116a. **Student's Spectroscope**, very simple pattern, Figure, with triple prism (direct-vision), non-adjustable gap, on wood stand for convenience of manipulation

1.9.0

- 54117a. **Pocket Spectroscope with Diffraction Grating**, Figure, showing hundreds of lines in the solar spectrum; the D line is split up

3.0.0

A good imitation of a genuine Rowland Grating is used as Diffraction Grating for the instrument.

- 54119a. **Pocket Spectroscope after Hofmann**, Figure

6.0.0

The spectroscope is provided with a telescope of approx. power 4, movable between pivot screws, also with a prism-system of 9° dispersion. The spectrum is consequently greatly extended. The construction is similar to that of the Janssen-Hofmann Spectroscopes and the gap is very accurately constructed and adjustable. With scale and comparison prism, in case.

82857. — idem, very small pattern, Figure

1.5.0

82858. **Pocket Spectroscope with Diffraction Grating** and wave-length scale, Figure. **Description**

6.5.0

In this spectroscope, the dispersing agent is a small copy of a grating (145 000 lines per inch).

Cl. 7412, 1393,
1395, 4151,
7589, 7411.



54141. 1:5.



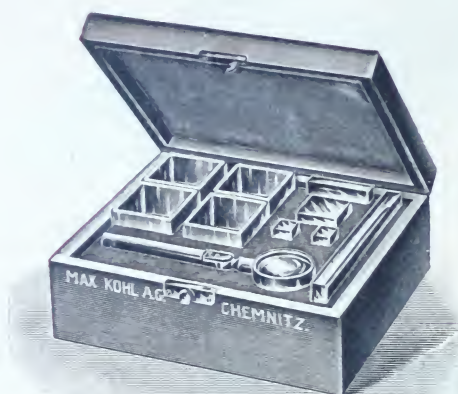
54135. 1:5.



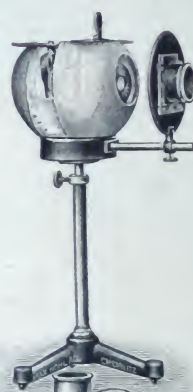
54225. 1:5.



54293. 1:4.



54242. 1:7.



54296. 1:9.



82859. 1:8.

Accessories for Spectrum Apparatus.

	£ s. d.
54135. Spectrum Lamp for continuous Vapour Spectra , after Eder and Valenta, with a rotating platinum wire net which plunges in the liquid (M. P. II, 1, Fig. 479), without platinum net The price of the platinum net (based on the current price of platinum) quoted on application.	5. 0.0
54138. 7 Diaphragms for Relief Spectra (M. T., p. 187 [188]), Figure	1. 4.0
54141. Collimator Tube with Micrometer Gap after Grimsehl, on Stand, for demonstrating the spectrum objectively (Ztschr. f. d. phys. u. chem. U. 20 , 1907, p. 209, Fig. 1 C), Figure . . .	1. 4.0
54225. Bunsen-Burner with Pan and Sheet-iron Cylinder , after Grimsehl, for reversing the sodium line, for objective demonstration (Ztschr. f. d. phys. u. chem. U. 20 , 1907, p. 209, Fig. 1 [B] and Fig. 2), Figure. Description	0.14.0

Fluorescence, Model of Eye, Colour-mixing.

54242. Collection for Fluorescence Experiments , Figure, consisting of 4 hollow glass cubes for liquids, Uranium glass plate, Uranium glass cube, Didymium glass and flourspar, also condenser lens on stand	3.10.0
54293. Device for receiving an Ox's Eye , Figure, with small stand for the eye lens ((W. D., Fig. 300—302 [283—285])	0. 6.0
54296. Optical Eye after Grimsehl, Figure, arranged for filling with water, with diaphragm for the insertion of spectacle lenses. The variations in magnitude occurring in a short-sighted or long-sighted eye when a spectacle lens is inserted can be measured	1.18.0
82859. Colour-Mixing Apparatus after Weinhold, Figure, by means of thick films of coloured solutions (Weinhold, Physikal. Demonstration 1913, pp. 478—480)	3.10.0

Cl. 7204,
6130, 6977, 6274, 6906,
6119, 7104, 6814.



82 860—82 867, 82 884—82 888.



82 903—82 905.



82 876—82 883, 82 894—82 897.



82 898—82 902.

Aplanatic Magnifying Glasses.

Magnifying Glasses on Handle, with brass mount, black-lacquered, and knurled, nickel-plated grip, Figure.

List No.	Magnification	Diameter	Price £s.d.	List No.	Magnification	Diameter	Price £s.d.
82 860	4 ×	27 mm	0.5.3	82 864	12 ×	12 mm	0.5.3
82 861	6 ×	24 mm	0.5.3	82 865	16 ×	8,5 mm	0.5.3
82 862	8 ×	17 mm	0.5.3	82 866	20 ×	7,5 mm	0.5.3
82 863	10 ×	15 mm	0.5.3	82 867	40 ×	3,8 mm	0.5.3

Magnifying Glasses on Handle, with black-lacquered Aluminium mount and with aluminium grip.

List No.	Magnification	Diameter	Price £s.d.	List No.	Magnification	Diameter	Price £s.d.
82 868	4 ×	27 mm	0.5.3	82 872	12 ×	12 mm	0.5.3
82 869	6 ×	24 mm	0.5.3	82 873	16 ×	8,5 mm	0.5.3
82 870	8 ×	17 mm	0.5.3	82 874	20 ×	7,5 mm	0.5.3
82 871	10 ×	15 mm	0.5.3	82 875	40 ×	3,8 mm	0.5.3

Folding Magnifying Glasses of same design, but with nickelled-brass mounts, Figure.

List No.	Magnification	Diameter	Price £s.d.	List No.	Magnification	Diameter	Price £s.d.
82 876	4 ×	27 mm	0.8.3	82 880	12 ×	12 mm	0.8.3
82 877	6 ×	24 mm	0.8.3	82 881	16 ×	8,5 mm	0.8.3
82 878	8 ×	17 mm	0.8.3	82 882	20 ×	7,5 mm	0.8.3
82 879	10 ×	15 mm	0.8.3	82 883	40 ×	3,8 mm	0.8.3

Achromatic Magnifying Glasses.

Magnifying Glasses on Handle, with black-lacquered brass mount and knurled, nickel-plated grip, Figure.

List No.	Magnification	Diameter	Price £s.d.	List No.	Magnification	Diameter	Price £s.d.
82 884	4 ×	24 mm	0.2.0	82 887	10 ×	13,5 mm	0.2.4
82 885	6 ×	21 mm	0.2.0	82 888	12 ×	13 mm	0.2.4
82 886	8 ×	16 mm	0.2.4				

Magnifying Glasses on Handle, with black-lacquered aluminium mount and with aluminium grip.

List No.	Magnification	Diameter	Price £s.d.	List No.	Magnification	Diameter	Price £s.d.
82 889	4 ×	24 mm	0.2.0	82 892	10 ×	13,5 mm	0.2.4
82 890	6 ×	21 mm	0.2.0	82 893	12 ×	13 mm	0.2.4
82 891	8 ×	16 mm	0.2.4				

Folding Magnifying Glasses of same design, but with nickel-plated brass mounts, Figure.

List No.	Magnification	Diameter	Price £s.d.	List No.	Magnification	Diameter	Price £s.d.
82 894	6 ×	21 mm	0.3.0	82 896	10 ×	13,5 mm	0.3.6
82 895	8 ×	16 mm	0.3.6	82 897	12 ×	13 mm	0.3.6

Reading Glasses in Brass Mount, lacquered black egg-shell finish, and with black lacquered wood handle, Figure.

List No.	Diameter	Price £s.d.	List No.	Diameter	Price £s.d.
82 898	55 mm	0.2. 5	82 901	85 mm	0.3. 5
82 899	65 mm	0.2. 6	82 902	95 mm	0.4. 0
82 900	75 mm	0.2.10			

Standing Type Reading Glasses, Figure, with bi-convex lens, black enamelled, on metal base.

List No.	Diameter	Price £s.d.
82 903	60 mm	0.5.10
82 904	75 mm	0.6. 6
82 905	90 mm	0.6.11

Microscopes.



82 906.



82 909.

Large and Medium Microscopes.

- | | £ | s. | d. |
|---|-----|-----|----|
| 82 906. Large Microscope , Equipment 1, Figure, with ball-and-socket joint and lever for swivelling and fixing. Large round object stage, capable of being rotated and centred, 125 mm diam. Coarse and fine tube adjustment. Extra wide tube for photo-micrography and projection. Large Abbe-type illuminator with triple-lens condenser Num. Ap. 1,40, and cylindrical iris diaphragm. Extra-large movable cross-stage. Optical Equipment for Magnifications of 11—3500
Revolving holder for 4 objectives; large Abbe type indicating apparatus. Objectives: 0, 2, 3, 5; Fluorite Systems 6a, 8a; homogenous oil-immersion 1,8 mm N.A. 1,30, and 1,4 mm N.A. 1,30. Oculars: 1, 2, 3, 5. Micrometer ocular: IV.; Compensating Ocular: 12, 18. | 38. | 0. | 0 |
| 82 907. — idem, Equipment. Optical Equipment for Magnifications of 20—1400 , without indicating apparatus
Revolving holder for 3 objectives. Objectives: 1, 3, 5, 7; oil-immersion: 1,8 mm N.A. 1,30. Eyepieces: 1, 2, 3, 5; Micrometer Eyepiece: IV. | 22. | 0. | 0 |
| 82 908. — idem, Equipment 3, with illuminator with double-lens condenser Ap. 1,20. Optical Equipment for magnifications of 48—1400
Revolving holder for 3 objectives. Objectives: 3, 7; oil-immersion: 1,8 mm N.A. 1,30. Eyepieces: 2, 4, 5. | 19. | 10. | 0 |
| 82 909. Large Microscope , Equipment 1, Figure, swivelling type. Large, round object-stage capable of being rotated and centred, 105 mm diam. Coarse focussing by rack-and-pinion; fine focussing by draw-tube with millimetre scale. Medium illuminator with side screw for raising and lowering. Iris diaphragm with lorgnette for taking glass discs for dimming the light. Optical Equipment for magnifications of 36—1400
Revolving holder for 3 objectives. Objectives: 2, 5, 7; oil-immersion: 1,8 mm N.A. 1,30. Eyepieces: 2, 4, 5. | 14. | 5. | 0 |
| 82 910. — idem, Equipment 2, with illuminator and screw. Optical Equipment for magnifications of 65—1400
Revolving holder for 3 objectives. Objectives: 3, 7; oil-immersion: 1,8 mm N.A. 1,30. Eyepieces: 2, 4, 5. | 13. | 10. | 0 |
| 82 911. — idem, Equipment 3. Optical Equipment for 65—720 magnifications , with illuminator and screw
Revolving holder for 3 objectives. Objectives: 3, 7, 9. Eyepieces: 2, 4. | 12. | 5. | 0 |

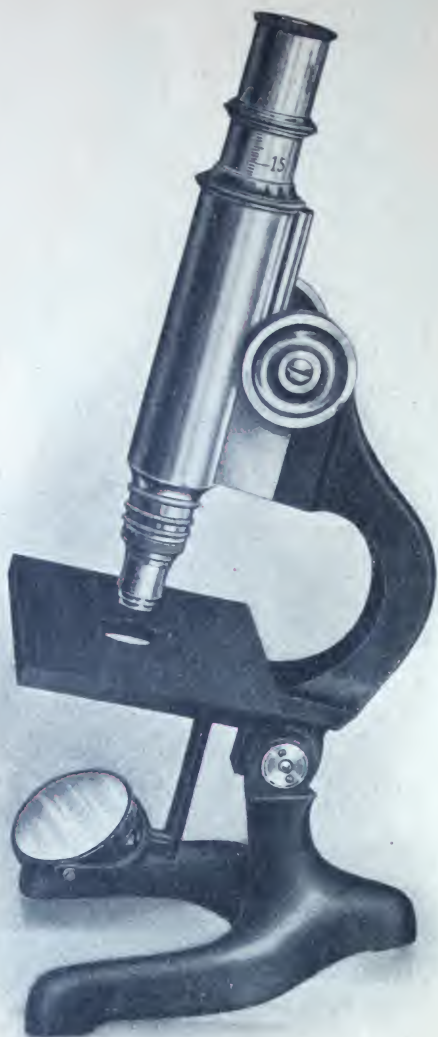


82912.

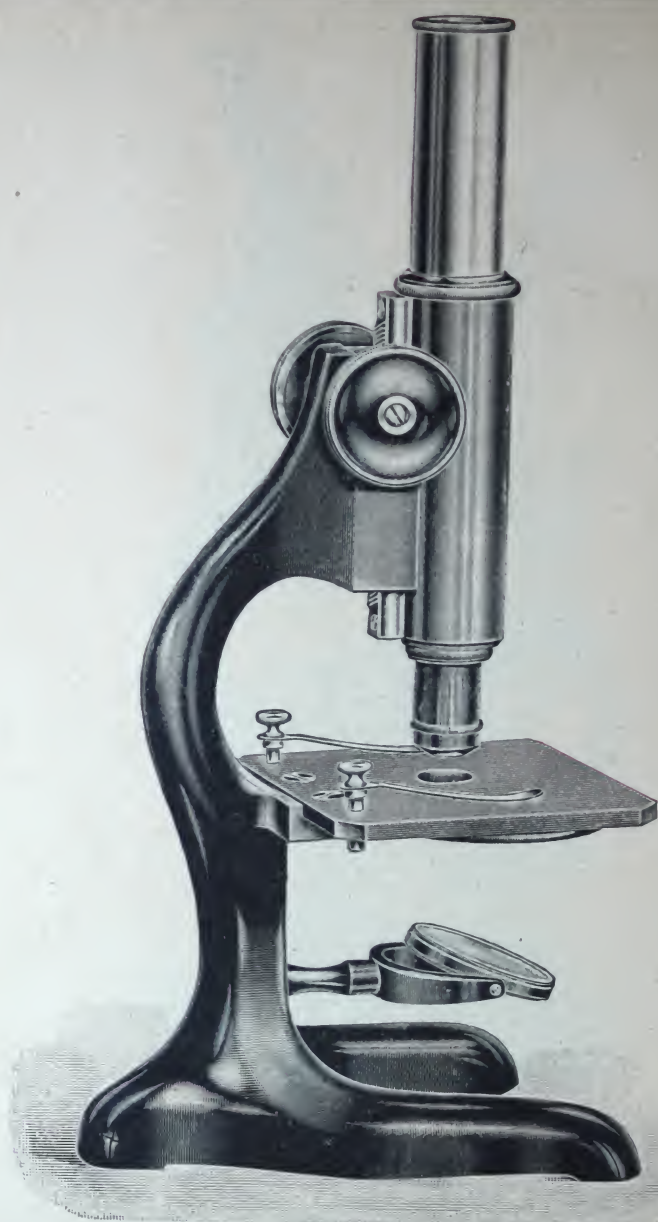


82916.

82912. **Medium Microscope**, Equipment 1, Figure, tilting through 90°. Fixed, rectangular object-stage with ebonite cover. Coarse focussing by rack-and-pinion; fine focussing by draw-tube with millimetre scale. Medium illuminator with lateral screw for raising and lowering. **Optical Equipment for 65—1400 magnifications** £ s. d.
 Revolving holder for 3 objectives. Objectives: 3, 7. Oil-immersion 1.8 mm N. A. 1.30. Eyepieces: 2, 4, 5. 12. 5.0
82913. — idem, Equipment 2, with illuminator and side screw. Stage without ebonite cover. **Optical Equipment for 65—720 magnifications** 10. 15.0
 Revolving holder for 3 objectives. Objectives: 3, 7, 9. Eyepieces: 2, 4.
82914. — idem, Equipment 3, with illuminator. **Optical Equipment for 65—620 Magnifications** 7. 15.0
 Revolving holder for 2 objectives. Objectives: 3, 8. Eyepieces: 2, 4.
82915. — idem, Equipment 4, without illuminator. **Optical Equipment for 54—496 Magnifications** 7. 0.0
 Objectives: 3, 8. Eyepieces: 1, 3.
82916. **School Microscope**, Equipment 1, Figure, tilting to 90°. Extra-large, fixed object-stage. Coarse focussing by rack-and-pinion; lateral lever-micrometer fine focussing. Also draw-tube with millimetre scale. Medium illuminator with iris diaphragm and lorgnette for holding ground-glasses. **Optical Equipment for 65—1400 Magnifications** 10. 15.0
 Revolving holder for 3 objectives. Objectives: 3, 7. Oil-immersion 1.8 mm N. A. 1.30. Eyepieces: 2, 4, 5.
82917. — idem, Equipment 2, with illuminator. **Optical Equipment for 65—720 Magnifications** 9. 10.0
 Revolving holder for 3 objectives. Objectives: 3, 7, 9. Eyepieces: 2, 4.
82918. — idem, Equipment 3, without illuminator or revolving holder. **Optical Equipment for 24—620 Magnifications** 6. 10.0
 Objectives: 1, 3, 8. Eyepieces: 2, 4.
82919. — idem, Equipment 4, without illuminator and revolving objective-holder. **Optical Equipment for 86—496 Magnifications** 5. 15.0
 Objectives: 3, 8. Eyepiece: 3.



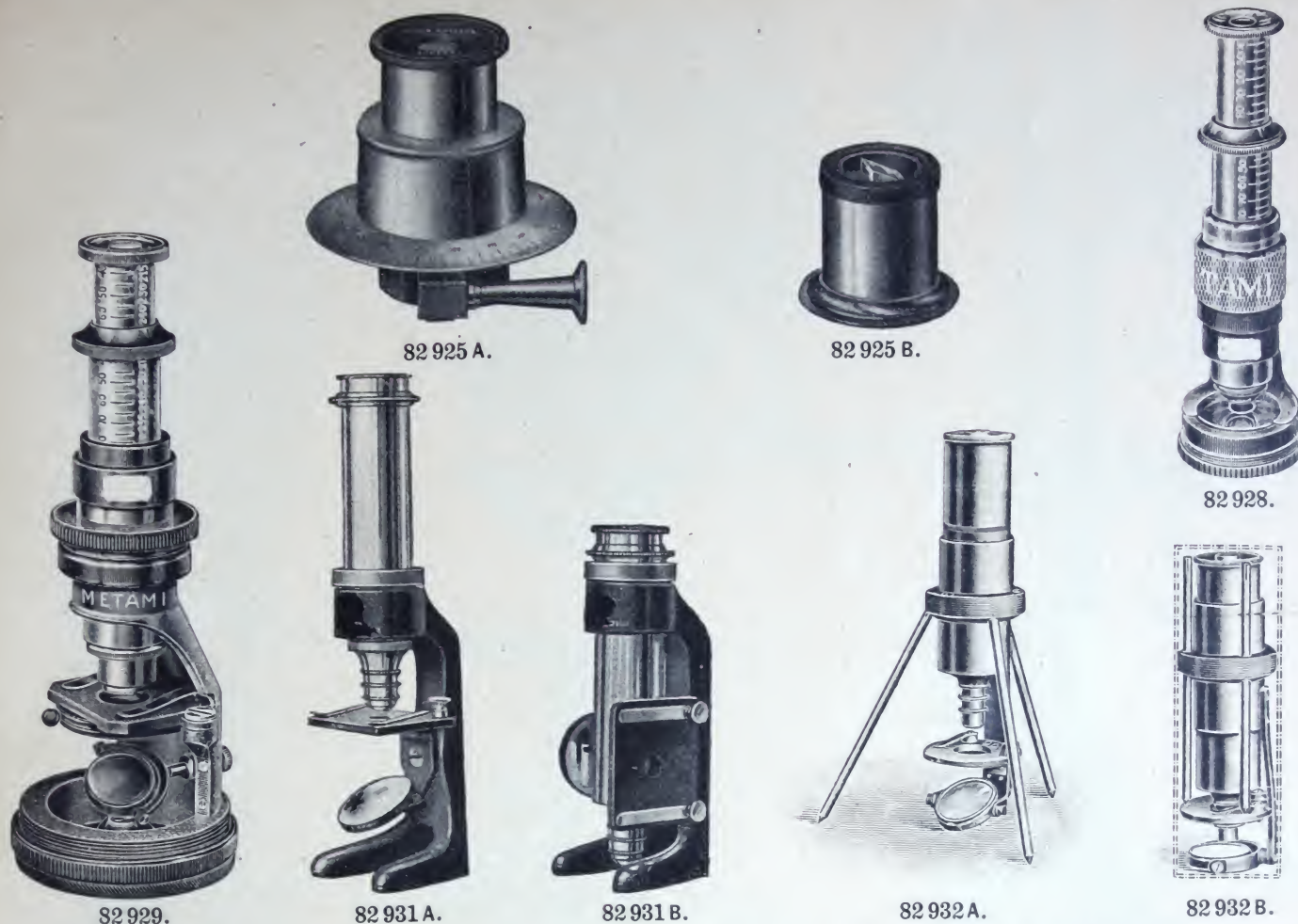
82 920.



82 923.

Max Kohl, Aktiengesellschaft, Chemnitz, Germany.

82 920. Small Microscope , Equipment 1, Figure, tilting. Rack-and-pinion focussing. Fixed square stage (90×105 mm), non-extending tube. Diaphragm with various openings. Movable concave and plane mirror. Optical Equipment for Magnifications of 54—108	£ s. d.
Objective: 3. Eyepieces: 1, 4.	3. 0.0
82 921. — idem, Equipment 2, with fine tube-focussing. Optical Equipment for 65—390 Magnifications	
Objectives: 3, 6. Eyepieces: 2, 4.	4. 5.0
82 922. — idem, specially arranged for showing trichinæ, with large, detachable object-stage (180×90 mm), with guide for taking the compression device, diaphragm, concave and plane mirrors. Optical Equipment for 54—108 Magnifications	
Objective: 3. Eyepieces: 1, 4.	3. 5.0
82 923. Small Microscope , Figure, non-tilting; rack-and-pinion focussing. Fixed rectangular stage. Diaphragm with various openings. Concave and plane mirrors. Optical Equipment for 54—108 Magnifications	
Objective: 3. Eyepieces: 1, 4.	2.15.0
82 924. — idem, specially arranged for showing the trichinæ, with large, detachable stage with guides for compression device. Optical Equipment for 54—108 Magnifications	
Objective: 3. Eyepieces: 1, 4.	3. 0.0
82 925. Large Polarisation Apparatus for use on the Microscope , Figures A and B, on page 1463, without condenser lens, for use on stands with large Abbe illuminator	2.15.0
82 926. — idem, with condenser lens, for stands with medium and simple illuminators	3. 0.0
82 927 a. Gypsum Slide	0. 4.0
82 927 b. Gypsum and Mica Discs , set of 8	0.15.0

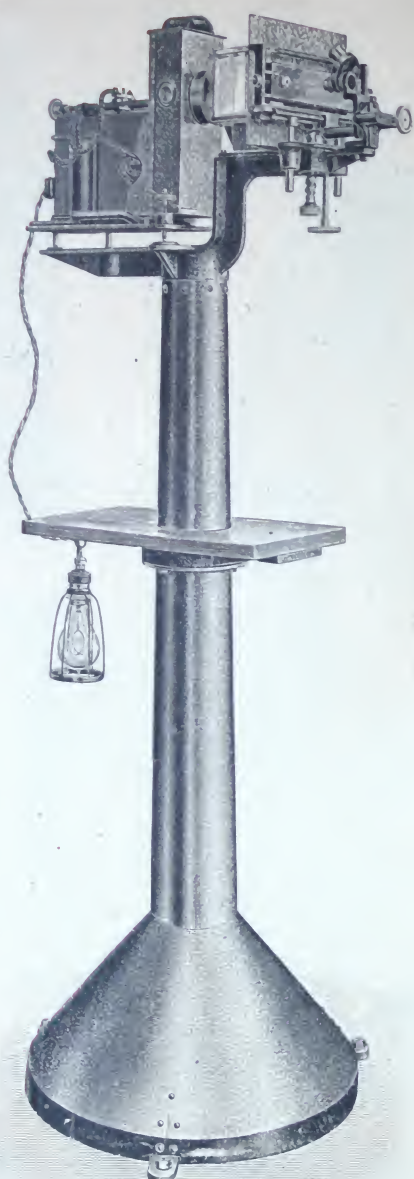


82928. **Pocket Microscope**, Figure, variable power between **25 and 225 Magnifications**, sensitive fine focussing. On removing the object-stage the microscope can be used for **micro-projection** or **photo-micrography**. Minimum dimensions of protecting sheath, $4,5 \times 10$ cm. Weight, about 18 oz £ s d.
2.10 0
- The power of the microscope can be varied (1) by **extending the tubes** to thrice their original length. The magnifications corresponding to the extension can be read off on the graduated draw-tubes. (2) **The compound objective**, consisting of two object glasses can be used, these being corrected so that the upper one can be used alone when the lower one is screwed down. In this case, all the values read off on the tube scale must be divided by two. **Fine focussing** is effected by turning the knurled ring, which enables the image to be **sharp y** focussed in any position of the tube.
82929. **Small "Metami" Microscope**, Figure, for **25—600 Magnification**. This is a complete design of the previously listed pocket microscope. With cover 5.10.0
82930. **Lighting Device** for Microscopes 82928 and 82929. It is fixed by means of a ring and universal joint. The light-source is a small electric bulb connected to a flash-lamp battery 0.10.0
82931. **Small "Klemi" Microscope**, Figures A and B. Coarse focussing by draw-tube, fine focussing by turning a knurled ring. Special triple objective. Weight about 300 grams. Minimum dimensions, 45×125 mm 2. 5.0
- Any microscope eyepiece may be used with this microscope. Fitted with eyepiece II. to $\times 20$, the following table of magnifications is obtained.

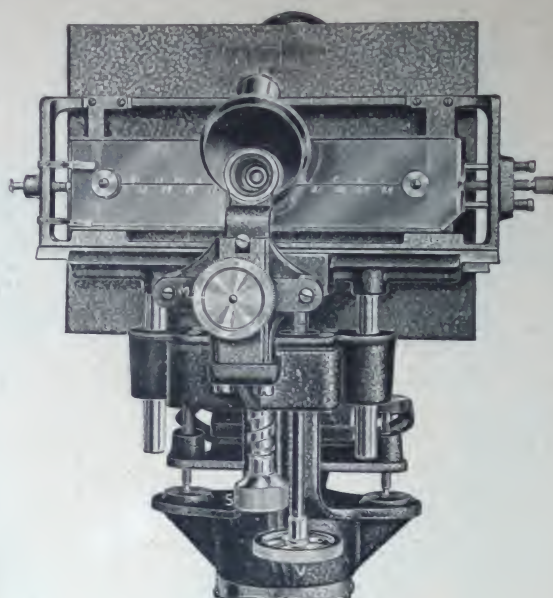
Objectives	Magnification of Objectives	Eyepieces							Remarks
		II	III	IV	V	16×	18×	20×	No. of Eyepiece
		6	8	10	12	16	18	20	Magnification
1	4.2	25	34	42	50	67	76	84	n. Ap. = 0,10
1 and 2	8,4	50	68	84	100	134	151	168	n. Ap. = 0,20
1, 2 and 3	14,0	84	112	140	168	224	252	280	n. Ap. = 0,40

The price includes **one** eyepiece and the special triple objective.

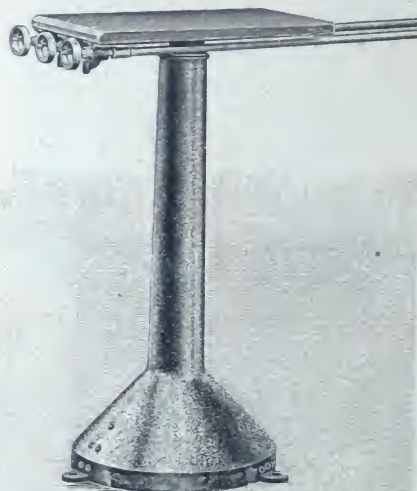
82932. **"Junior" Pocket Microscope**, Figures A and B. Tube with objective and eyepiece, tube guide, stage with clamps for securing objects, lighting mirror with holder 0.14.0
- Fig. A shows the microscope ready for use. The feet are placed in the skew holes of the screwed ring on the tube **sleeve**. For carrying purposes, the feet are placed in the **straight** holes of the screwed ring and the two parts of the container screwed on to the screwed ring, Fig. B.



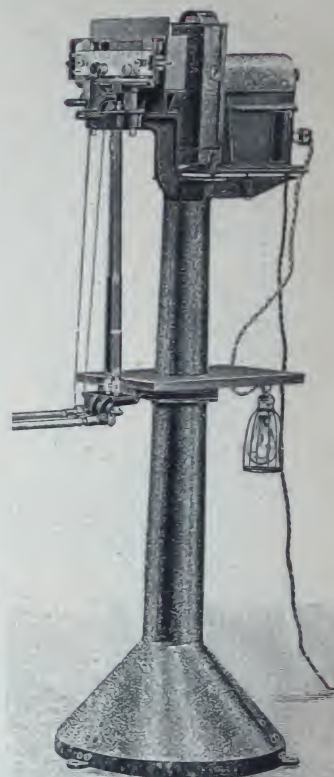
82 935 A.



82 935 B.



82 933, 82 934.

**Trichinoscope.**

- 82 933. **Trichinoscope with fine Focussing, Figure, for 110 V. Direct Current.** The apparatus comprises a fixed round iron stand carrying the two **Lighting Systems**, self-regulating arc lamp for direct current with carbons placed perpendicular to each other, plane-parallel plate glass cooling chamber, projection system and compressor supports with vertical and horizontal adjustment and compressor, and an iron table with pillar with the knobs for actuating the fine focussing, 100 pairs of carbons, rheostat for 100 volts. **Description**
- 82 934. — idem, for **220 V. Direct Current**
- 82 935. **Trichinoscope without Fine Focussing, Figures A and B, for 110 V. Direct Current**
 The apparatus comprises all the various parts enumerated under No 82 933 except the iron table and column with the fine adjustments. Fig B shows the compression gear support with compression gear.
- 82 936. — idem, with **220 V. Direct Current**

£ s. d.

34. 0.0

35. 0.0

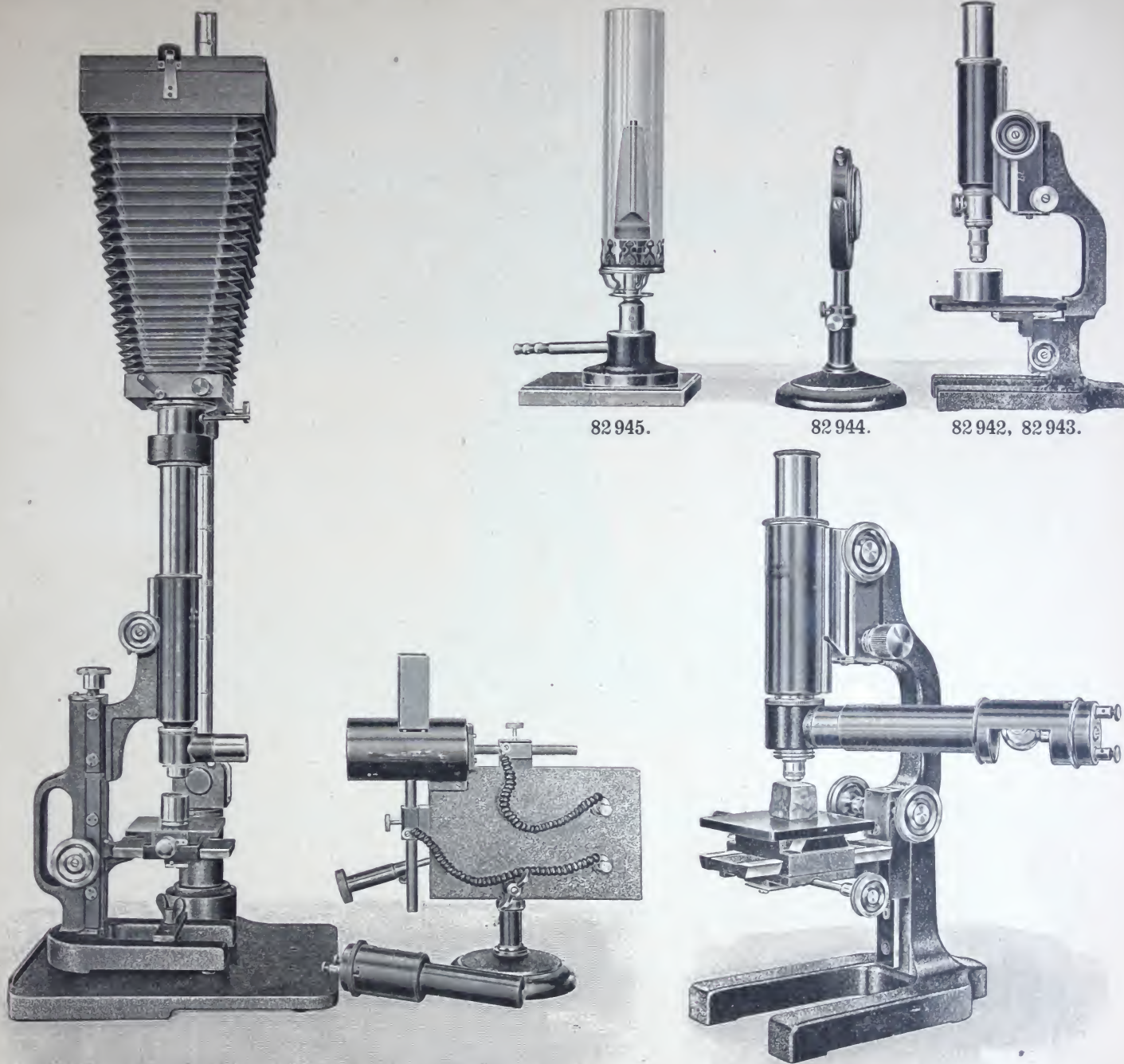
28. 5.0

29. 0.0

Optical Equipment for above Trichinoscopes.

- 82 937. **Projection System, 36 mm, for a Magnification of about 70**
- 82 938. **Projection System 36 mm, Projection System 16 mm, and Double Revolving Holder for two Magnifications, i. e., about 70 and 150**
- 82 939. **Micro-Luminar, 36 mm, for Magnification of about 70**
- 82 940. **Micro-Luminar, 36 mm, Micro-Luminar 16 mm and Double Revolving Holder, for two Magnifications, about 70 and 150**
 The microluminars meet more stringent requirements, as the sharpness extends over a wider area than is the case with the projection systems.
- 82 941. **Compression Device**

0. 2.0

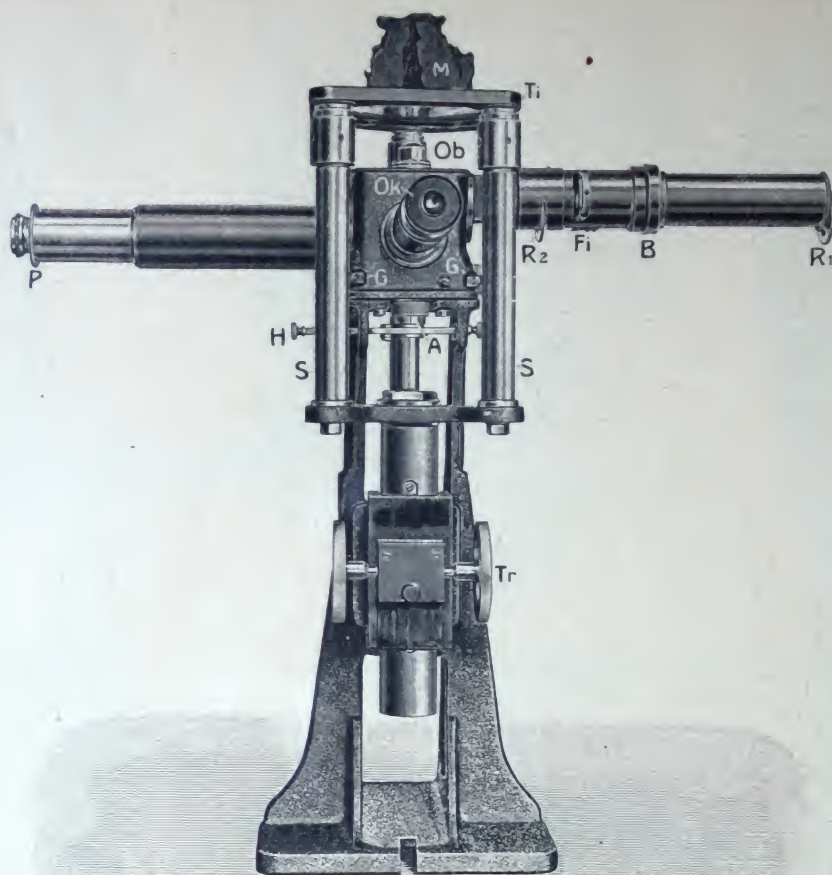


82947, 82952, 82951.

82947, 82950.

Metallurgical Microscopes.

		£	s.	d.
Small Metallurgical Microscope with adjustable Stage (Description), comprising:				
82942. Stand with lateral micrometer screw and object-stage with vertical adjustment. Coarse focussing by rack-and-pinion, fine adjustment by lateral micrometer screw (can be manipulated from both sides), and protector for the specimens, Figure		6.	2	0
82943. Vertical Illuminator, with plane-parallel glass plate and iris diaphragm, Figure		1.	15.	0
82944. Illuminating Lens with Iris Diaphragm, on base, Figure		1.	15.	0
82945. Incandescent Gas Lamp for Vertical Illuminator, on stand, Figure, or		1.	4.	0
82946. Electric Lamp for Vertical Illuminator, on Base		1.	10.	0
82947. Metallurgical Microscope with Adjustable Cross-stage, Figure, tube-length 170 mm. Description		11.	0	0
The object stage can be slid over a wide range in two directions perpendicular to each other. Coarse focussing of the tube by rack-and-pinion fine focussing by micrometer screw, arranged laterally and capable of manipulation from either side, with protector for the specimen.				
82948. Metal Stand for Photographing Large Specimens of Metal at low magnification by means of the Micro-luminars. Comprising a foot with rack adjustment and transverse stage		8.	12.	0
82949. Simple Vertical Illuminator for above		1.	15.	0
82950. Vertical Illuminator (Le Chatelier's), Figure, with illuminating prism, for the direct observation and photographing of opaque objects by means of object-glass and eyepiece		5.	0.	0
82951. Hand-Regulated Electric Lamp with Illuminating Lens on Vertical Stand, Figure, for the micro-photography of opaque objects. Can be connected up to any electric supply		2.	10.	0

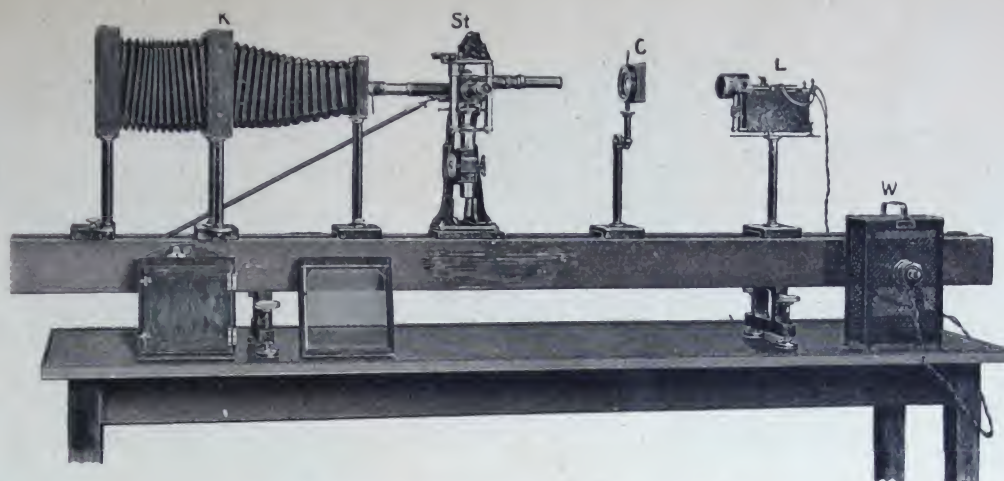


82960, 82961.

82952. Small Camera for Micro-Photography , Figure on p. 1465. Comprises iron base-plate, vertical column, adjustable camera with extension of 50 cm (about 20 ins.), ground-glass screen, plate-glass screen, and a metal dark slide 9×12 cm	£	s.	d.
82953. Fine Focussing for the Luminar		1.15	0
82954. Extra price for each additional dark-slide		0.	2.0
82955. Cupboard		0.10	0

Optical Equipment for above Metallurgical Microscopes.

Either:	82956 a. Achromat 1	0.14	0
	82956 b. " 3	1.	3.0
	82956 c. " 5	1.	8.0
	82956 d. " 7	1.15	0
	82956 e. Homogeneous Immersion , 1,8 mm, in short mount	4.	0.0
	82956 f. 3 Complanatic Eyepieces , 2, 3, 4	2.	0.0
Or:	82957 a. Achromat 1a	0.18	0
	82957 b. " 3a	1.15	0
	82957 c. " 5a	2.10	0
	82957 d. " 7a	3.	5.0
	82957 e. Homogeneous Immersion , 1,8 mm, in short mount	4.	0.0
	82957 f. 3 Complanatic Eyepieces , 2, 3, 4	2.	0.0
Or:	82958 a. Apochromat 24 mm	2.	0.0
	82958 b. Fluorite Systems , 13 mm	2.15	0
	82958 c. " 8,5 "	2.18	0
	82958 d. " 3 "	4.	0.0
	82958 e. Fluorite Immersion , 1,8 mm, in short mount	5.	8.0
	82958 f. 3 Complanatic Eyepieces , 2, 3, 4	2.	0.0
Or:	82959 a. Apochromat 24 mm	2.10	0
	82959 b. " 14 "	3.	7.0
	82959 c. " 7 "	4.	0.0
	82959 d. " 3 "	6.10	0
	82959 e. Apochromatic Oil-Immersion , 2 mm, in short mount	8.15	0
	82959 f. 3 Compensating Eyepieces , 2, 3, 5 for subjective observation	2.	0.0
	82959 g. 3 Complanatic Eyepieces 2, 3, 4 for microphotography	2.	0.0



82 960, 82 961, 82 967, 82 968, 82 969, 82 972, 82 973.

82 960. **Large Metallurgical Microscope** (after Le Chatelier), Figure on p. 1466, latest design; can be used from the highest magnifications down to $\times 15$; with cast-iron slider for the microscope. **Description** £ s. d.
38. 0.0

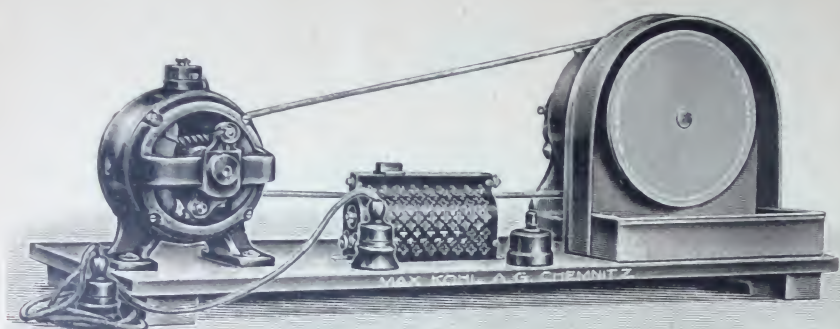
Accessories for the Le Chatelier Microscope.

82 961. Cast Iron Slide , fitting on to the flange, for carrying the microscope, Figure	1. 5.0
82 962 a. Apochromat 40 mm	2.10.0
82 962 b. " 24 mm	2.10.0
82 962 c. " 14 mm } In short mounts, corrected without cover glass {	3. 7.0
82 962 d. " 7 mm }	4. 0.0
82 962 e. " 3 mm }	6.10.0
82 963. Apochromatic Homogeneous Oil-Immersion , 2 mm, in short mount	8.15.0
82 964. Compensating Eyepieces , 2, 3 and 5, for observation purposes	2. 0.0
82 965. Projection Eyepiece 3e for photo-micrography	2. 5.0
82 966. Object Guiding Apparatus No. 3 , in case	4. 5.0
82 967. Large Cast-Iron Cheek or Flange , about 9 ft. long, with four feet arranged to serve as levelling screws, including base-plates	22. 0.0
82 968. Microphotographic Camera , length of extension 29", on 3 sliders with columns and clamping screws, including dark slides 20×20 cm, ground-glass screen and plain glass screen, Figure	12. 5.0
82 969. Adjusting Device , for adjusting the microscope micrometer screw away from the ground glass screen towards the dark slide	1. 0.0
82 970. 2 Adaptors in the Dark Slide for plates 13×18 cm and 9×12 cm	0. 9.0
82 971. Achromatic Focussing Glass for focussing the image on the transparent screen	1. 2.0
82 972. Self-Regulating Arc Lamp , 5 amps., for 110 or 220 V. Direct Current, on slide with pillar-stand, Figure	11. 0.0
82 973. Illuminator Lens on Slide with column, with iris diaphragm and screen for protecting the worker from radiation from the lamp, Figure	3.15.0
82 974. Object Stage or Holder , ground 13 mm diam. Each	0. 2.0
82 975. — idem, ground 23 mm diam. "	0. 2.0

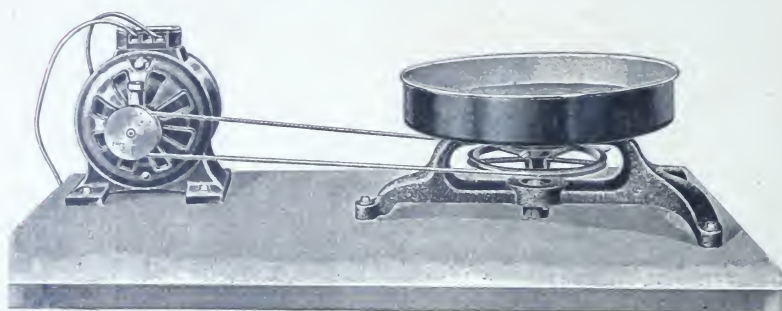
**Cutting, Grinding and Polishing Gear,
for preparing the Metal Samples for Microscopic Investigation.**

82 976. **Cold Saw**, Figure on p. 1468, directly driven by electric motor through worm gearing, with universal vice for material to 150×150 mm (6×6 ins.); length of saw-blade, 300 mm (12"); cut adjustable from 90—200 mm, for **Three-Phase or Direct Current**; including **Electric Motor**, and 6 Saw-blades 21.15.0

The vice clamps the material always in the central position, and enables the latter to be cut at any bevel-angle.



82977.



82978.



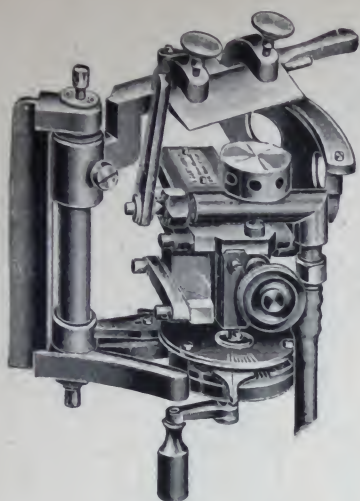
82976.

82977. Driving and Polishing Machine, electric motor driven, Figure, with rheostat, with one iron bob for taking emery paper or for wet grinding with loose emery	£ s. d. 12. 0.0
82978. Grinding and Polishing Machine, electric motor driven, Figure, with horizontal grinding bob 10" diameter, with electric motor	14. 0.0
82979. — idem, with grinding bob 8" diameter, with electric motor	9.15.0

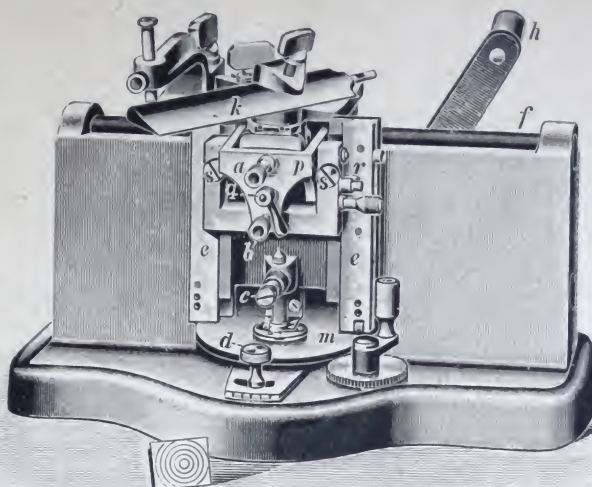
When ordering please state type of current and voltage of the electric supply.

Microtomes.

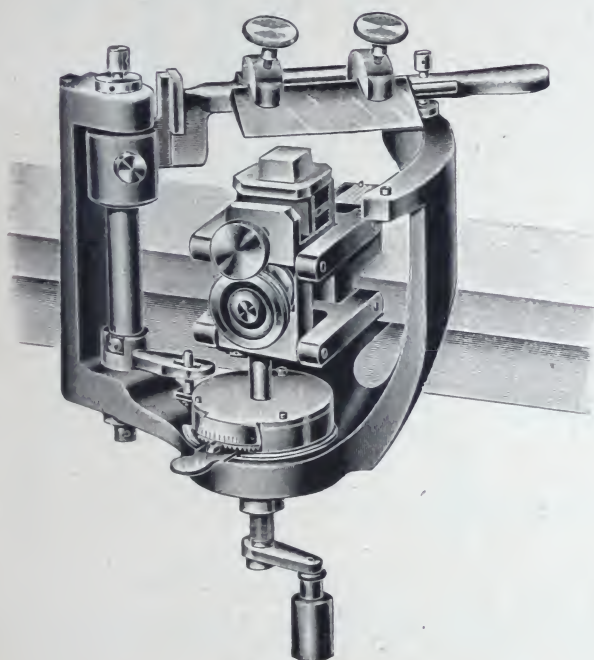
82980. Students' Microtome, Figure on p. 1469, with automatic adjustment of cutting thickness in stages of 10 microns. Table and clamps for specimens	3. 0.0
The instrument is made throughout of iron and well lacquered, bright parts nickelled. With rectangular guides for the specimen table.	
82980 a. 1 Cutter, 3½" long, in case, with sharpener	0.12.0
82980 b. 1 Object Clamp	0. 6.6
82980 c. Ether Freezing Apparatus for above	0.14.0
82980 d. 1 Box with lock and key	0. 8.0



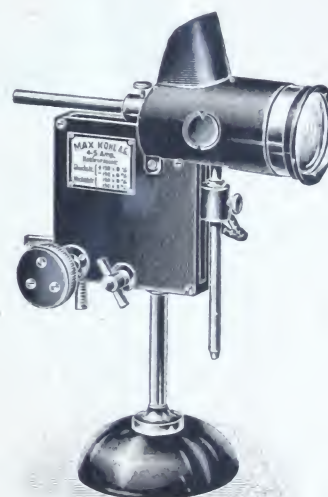
82980.



82982.



82981.



82985.

82981. **Microtome** with specimen stage, with automatic adjustment of thickness of cut every 5 microns, Figure. **Description** £ s. d.
12. 0.0

With 1 Carbon Dioxide Freezer, 1 Freezing Apparatus with ether spray, complete; 1 second brass clip for tangential cuts, 1 Cutter 8 cm long, in case, with hone, 1 object clamp, 1 table for specimens, 1 CO₂ bomb holding 10 litres, 1 collapsible stand for CO₂ bomb, 1 case with lock, 1 setting device for setting cutting width every 2½ micron. 1 Spiral Tube as spare.

It is advisable to keep 2 carbon dioxide cylinders, one being used as a reserve while the other is being refilled, as the hire fee for a cylinder is fairly high.

82982. **Microtome with Crank Movement**, Figure, Universal Specimen Clamp and automatic Adjustment. **Travel, 30 cm** 15.10.0

1 Simple Cutter Clamp, 1 cutter, 17 cm, in case with hone, 1 Universal Knife Clamp, 1 carbon dioxide freezer. Ready for cutting.

82983. — idem, 40 cm length of travel, knife 20 cm, ready mounted for cutting 18. 5.0

82984. **Dwarf Arc Lamp**, for 4—5 amps. current, on stand 1.10.0

This lamp can be connected up to any domestic lighting circuit by means of a plug contact and the insertion of a suitable resistance. When ordering, please state for what type of current the lamp is required.

82985. — idem, with illuminator lens, Figure 2. 0.0

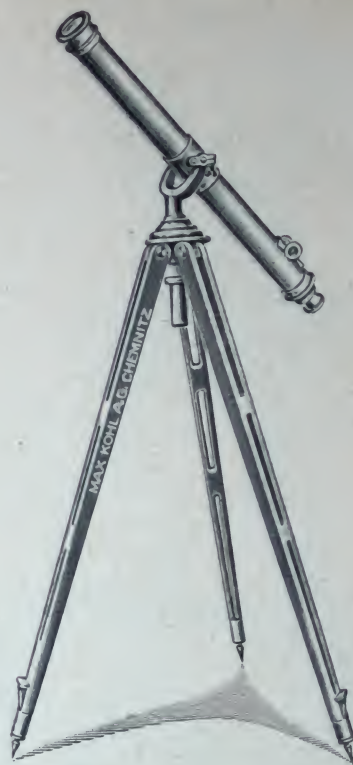
82986. — idem, with clockwork regulation 3. 5.0

82986 a. **Resistance, 110 Volts.** for dwarf arc lamps Nos. 82984, 82985, 82986 0.10.0

82986 b. — idem, for 220 Volts 0.18.0



82 987 - 82 990.



82 991 - 82 994.

Telescopes.

Azimuth Telescopes.

Telescope on Table Stand, Figure, Telescope body of brass, white lacquered, Table Stand of Iron, black lacquered; head of stand having **horizontal** and **vertical** motion, Sharp focussing of eyepiece by rack and pinion. The telescope, with accessories (excluding stand) is fitted in a lock-up wood box.

List No.	Diameter of Object Glass mm	Number of Eyepieces		Magnifications		Without Finder £	With Finder £
		Terrestrial	Astronomical	Terrestrial	Astronomical		
82 987	59	1	2	35	35, 50	12. 5.0	14.15.0
82 988	68	1	3	44	44, 63, 87	15.10.0	18. 0.0
82 989	75	1	3	52	52, 75, 105	19. 5.0	21.15.0
82 990	82	1	3	61	61, 88, 122	22.10.0	25.10.0

Telescopes on wood Stand, Figure, of white-lacquered brass, light-polished wood stand with three movable folding feet, telescope adjustable for height, stand head with **horizontal** and **vertical** movement, fine adjustment of eyepiece by rack and pinion. The telescope and its accessories (less stand) are placed in a lock-up wood box.

List No.	Diameter of Object Glass mm	Number of Eyepieces		Magnifications		Without Finder £	With Finder £
		Terrestrial	Astronomical	Terrestrial	Astronomical		
82 991	68	1	3	44	44, 63, 87	16.0.0	18.10.0
82 992	75	1	3	52	52, 75, 105	20.0.0	22.10.0
82 993	82	1	3	61	61, 88, 122	23.5.0	26. 5.0
82 994	95	2	4	64,78	56, 78, 113, 157	34.0.0	37. 0.0

Max Kohl, Aktiengesellschaft, Chemnitz, Germany.



82 995 – 82 998.

82 999 – 83 002.

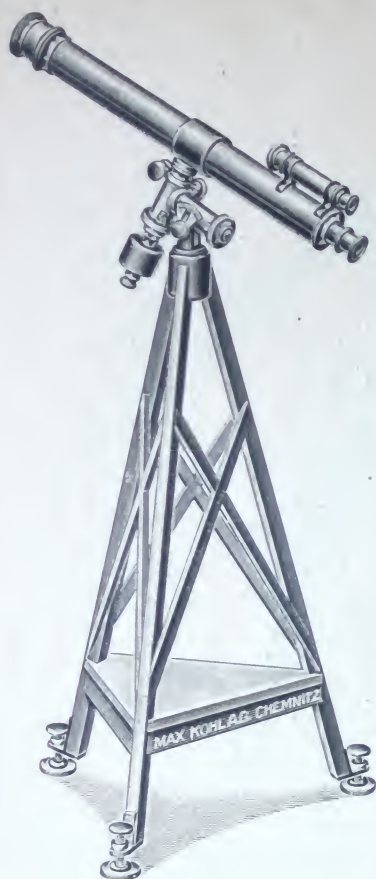
Telescopes on collapsible tubular steel stands, Figure. The telescope body is white-lacquered brass; height adjustment by hand-wheel; top of stand movable in **horizontal** and **vertical** directions. Rack and pinion fine focussing of eyepiece. The telescope and its accessories (excluding the stand) are fitted in a lock-up wood box.

List No.	Diameter of Object Glass mm	Number of Eyepieces		Magnifications		Without Finder £	With Finder £
		Terrestrial	Astronomical	Terrestrial	Astronomical		
82 995	75	1	3	52	52, 75, 105	26. 0.0	28.10.0
82 996	82	1	3	61	61, 88, 122	29. 5.0	32. 5.0
82 997	95	2	4	64, 78	56, 78, 113, 157	40. 5.0	43.10.0
82 998	109	2	4	71, 87	62, 87, 125, 175	48.10.0	52. 0.0

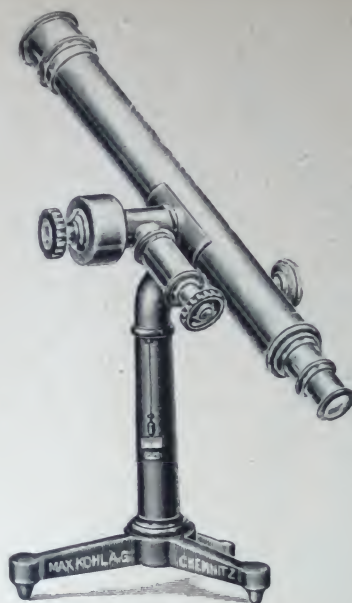
Telescopes, on Tripod Stand, for setting on the ground, Figure.

The stand is light but very sturdily built. The top is massive and of ample diameter, thus adding to the rigidity of the whole. The telescope is suspended in a gimbal which permits of observations being made to the zenith. It can be fitted with clamps and fine adjusting screw for horizontal and vertical movement. The telescope is perfectly balanced. A simple pinewood box contains the telescope when not in use.

List No.	Aperture mm	Focal length cm	Magnifications		With stand, but without Finder £	With Stand and Finder £
			Terrestrial	Astronomical		
82 999	60	75	38	30, 62, 94	23.10.0	26. 0.0
83 000	70	100	50	40, 83, 125	26. 5.0	28.15.0
83 001	80	125	50	50, 104, 156, 200	36.10.0	39. 0.0
83 002	90	140	56	56, 116, 175, 233	41.15.0	44. 5.0



83 009 - 83 012.



83 014.

- 83 003. **Clamping Arrangement and Fine Adjustment Screws** with key, for the horizontal and vertical motion £ s. d.
 83 004. **Worm Drive with Handle**, for raising and lowering 6. 5.0
 83 005. **1 Sun Glass** in mount, easily interchangeable. Is included in above prices. 8. 0.0
 83 006. **Spare Sun Glasses**. Each 0. 1.0
 83 007. **Prism for screwing on** the eyepiece cover, for observation at steep angles 0.12.6
 83 008. **Zenith Prism** 2.10.0

Parallactic Telescopes and Refractors.

Telescopes on Pyramidal Wood Stand, Figure, with base screws, without Fine Adjustment.

Brass, white-lacquered telescope body.

Parallactic system of axes with **divided circles for hour and declination**, hour-circle in $\frac{1}{4}$ hours, declination at 5" intervals. Hour adjustment by clamp-lever, declination fixed by screw clamp. Spirit level on the stand; sharp focussing of eyepiece by rack-and-pinion. The telescope and accessories (less stand) are fitted in a lock-up wood box.

List No.	Diameter of Object Glass mm	Number of Eyepieces		Magnifications		Without Finder £	List No.	With Finder £
		Terrestr.	Astronom.	Terrestr.	Astronom.			
83 009	75	—	3	—	52, 75, 105	43. 5.0	83 009a	45.15.0
83 010	82	—	3	—	61, 88, 122	47.15.0	83 010a	50.15.0

— idem, with Fine Adjustment.

List No.	Diameter of Object Glass mm	Number of Eyepieces		Magnifications		Without Finder £	List No.	With Finder £
		Terrestr.	Astronom.	Terrestr.	Astronom.			
83 009b	75	—	3	—	52, 75, 105	62.15.0	83 009c	65. 5.0
83 010b	82	—	3	—	61, 88, 122	67. 5.0	83 010c	70. 5.0
83 011	95	—	4	—	56, 78, 113, 157	80. 0.0	83 011a	83. 5.0
83 012	109	—	5	—	62, 87, 125, 175, 224	91. 0.0	83 012a	94.10.0

83 014. **Parallactically mounted Telescope, Figure, of brass, white lacquered, on Iron Stand** (black lacquered)

The parallactic axial system is arranged for a polar altitude of about 50°. The polar altitude can be varied by about 5° above and below by tilting the instrument accordingly. Diameter of object-glass, 59 mm, 1 astronomical eyepiece of 12.5 mm focal length and $\times 50$ magnification, 1 sun glass.

9.10.0

83 015. **Terrestrial Eye-Piece** for $\times 29$, for above

0.19.0

83 016. — idem, for $\times 35$, for above

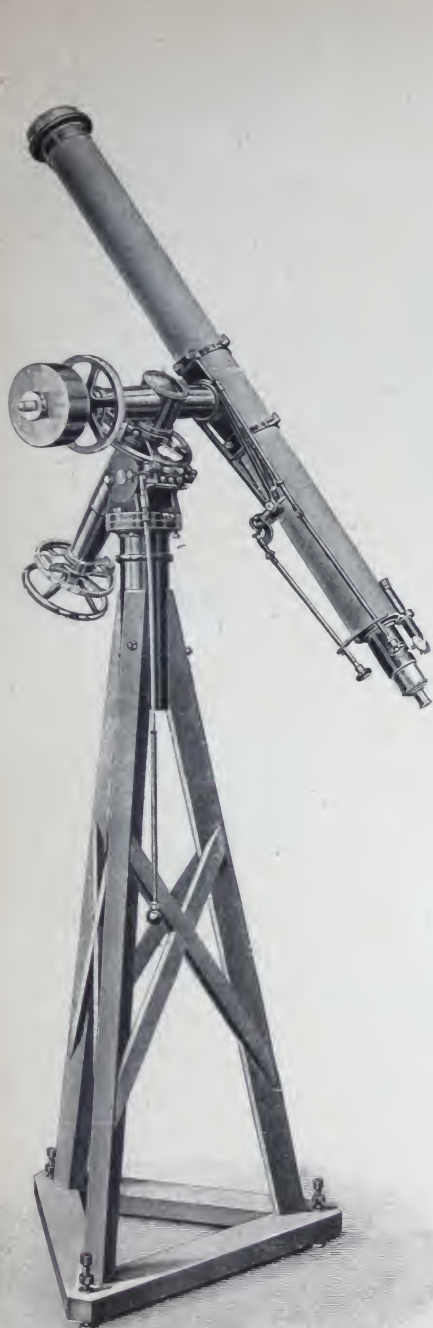
0.19.0

83 017. **Eyepiece Prism** for screwing on to the eyepiece head in place of the astronomical eyepiece, for observing stars near the zenith

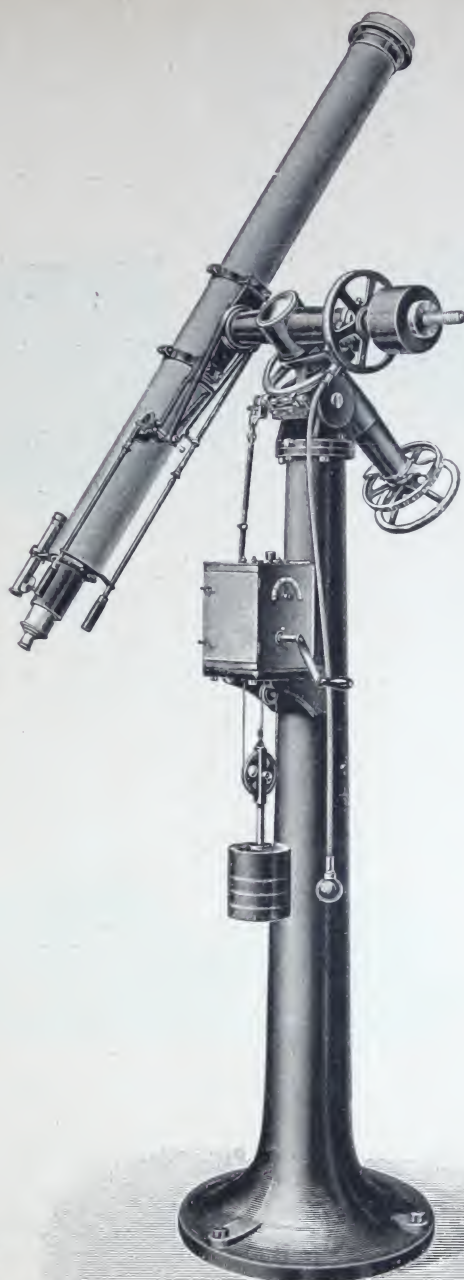
0.14.0

83 018. **Divided Circles for Hour and Declination**, hour-circle in $\frac{1}{4}$ hours, declination every 5°

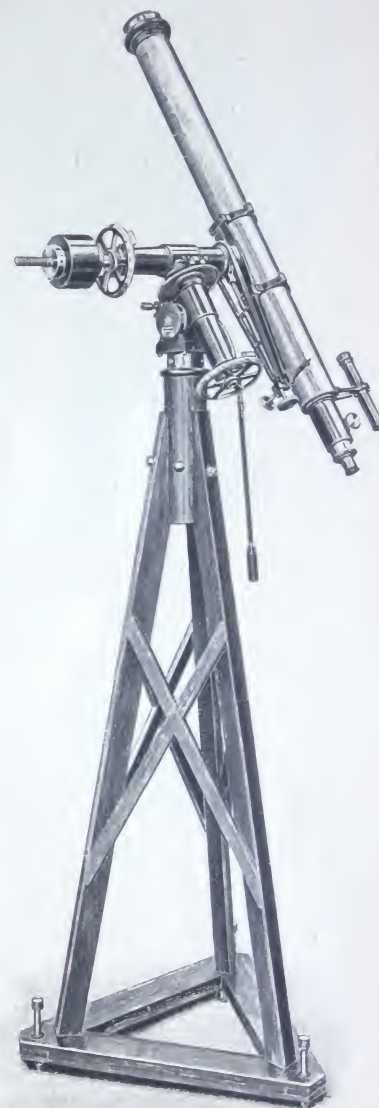
0.17.6



83 021.

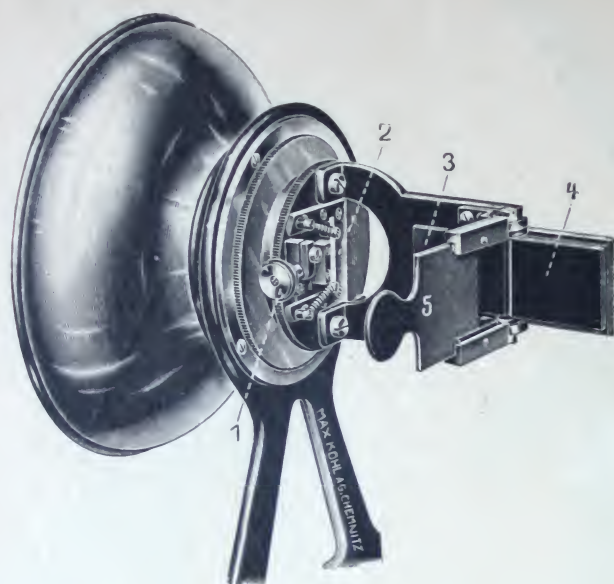


83 020.

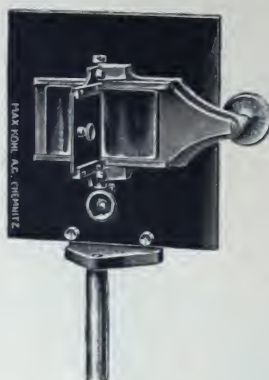


83 023.

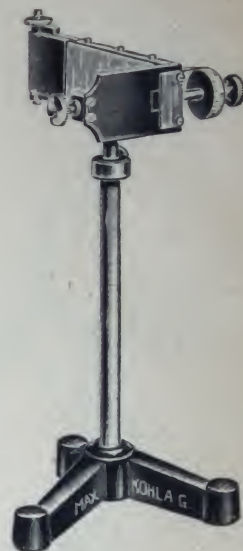
83 019. Refractor with objective 135 mm aperture and normal focus 200 cm, 6 astronomical eyepieces from 50—330 magnification, three solar glasses (eyepieces and solar glass in case), finder $\times 10$, without clockwork	£ s. d. 182.10.0
83 020. — idem , with Clockwork, Figure	213.15.0
83 021. Refractor with objective 110 mm aperture and normal focus 165 cm, 6 astronomical eyepieces from 66—270 magnification, three sun-glasses (eyepieces and sun-glasses in case), finder $\times 8$, Hour and Declination Circles , with double verniers indicating to 5' of arc and 20" of time respectively, Figure	83. 5.0
83 023. Refractor with objective 90 mm aperture and 140 cm normal focus, 4 astronomical eyepieces from 56—230 magnifications, three sun-glasses (eyepieces and sun-glasses in case), $\times 6$ finder, Hour and Declination Circles together with double verniers indicating 5' of arc and 20" of time; Figure	70. 5.0



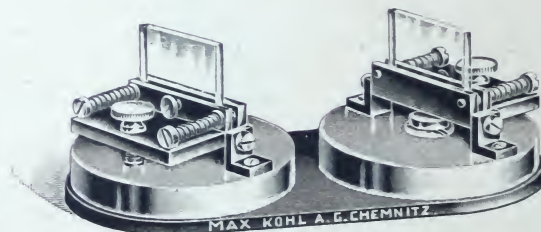
54514. 1:3.



54525 (54540). 1:4.



54527. 1:5.



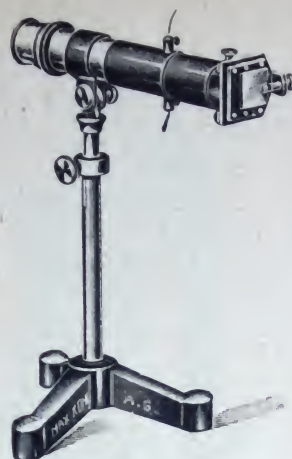
54529a and b. 1:3.

Interference and Diffraction.

- | | £ s. d. |
|---|---------|
| 54514. Interference Apparatus for Fresnel's Mirror Experiment , Figure, for screwing into the objective holder of the Projection Apparatus, in place of the objective, with adjustable gap, adjustable black mirrors and diaphragm; for Projection Apparatus having 43 mm diameter objective , Description | 4. 0.0 |
| This apparatus considerably facilitates the carrying out of Fresnel's Experiment since the gap and mirrors are combined ready for use. | |
| 54525. Ocular Micrometer after Fresnel, Figure, for measuring interference bands, on stand | 6. 0.0 |
| 54527. Interference Apparatus after Grimsehl, constructed on the Lloyd single mirror principle, thus obviating adjustment of the mirrors. The direct and the reflected image of the gap are used together for interference (<i>Ztschr. f. d. phys. u. chem. U.</i> , 20 , 1907, p. 217). The gap with micrometer screw for adjusting and screw for narrowing and widening are on stand , Figure | 3.10.0 |
| 54529a. Interference Apparatus after Classen, for demonstrating the phenomena before a large audience; interference is produced by reflection on two glass plates (Hassack-Rosenberg, <i>Projektionsapparate</i> , p. 230; Classen, <i>Natur des Lichts</i> , Fig. 9), Figure, Description | 2.10.0 |
| 54529b. 2 plane-parallel glass plates , for above, Figure | 1. 5.0 |



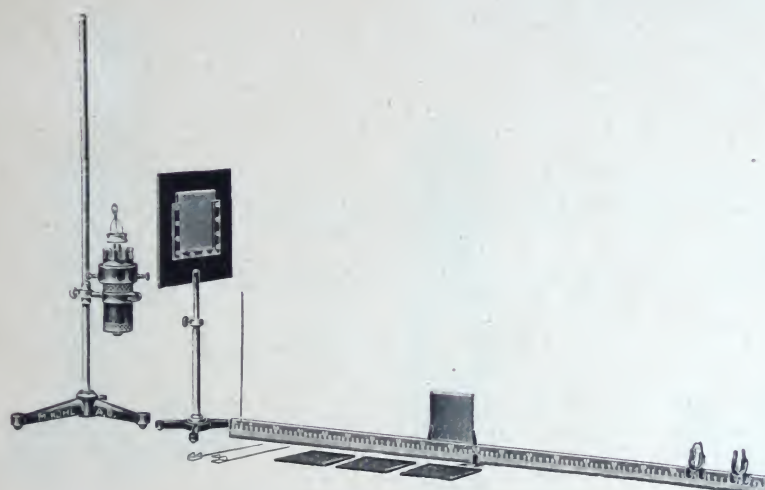
83 026 - 83 028.



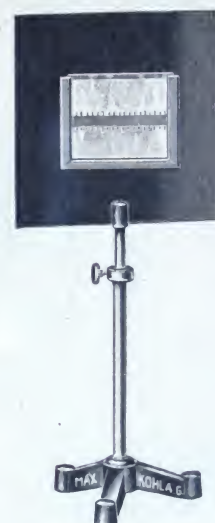
54 548. 1:6.



83 024. 1:4.



54 549. 1:10.



83 025. 1:10.

- 54 548. **Diffraction Apparatus for determining the wave length of light**, after Grimsehl (Ztschr. f. d. phys. u. chem. U. **17**, 1904, p. 135), Figure £ s. d.
2.10.0

Observation is taken on the diffraction bands formed by the gap, which can be simply regulated by means of the micrometer screw, the distance apart being read off direct on the eyepiece micrometer inside the tube. From the thickness d_1 of the wire, the distance apart d_2 of two adjacent strips (bands), and the distance apart a of the diffracting wire from the micrometer, we get the wave-length λ from the equation: $\lambda = d_1 \cdot d_2$. To enable the position of the micrometer to be recognised, its mount is somewhat thicker than the outer circumference of the tube. The clamping screws for the wire are fitted to a tube which can be slipped comfortably along the observing tube proper. By displacing the tube, two diffraction bands can be made to coincide with two scale-divisions of the eyepiece micrometer.

- 54 549. — idem, **for Students' Use**, after Grimsehl, comprising Nernst Lamp on stand, diaphragm with aperture, 4 coloured glasses, small optical bench, glass micrometer (E. Grimsehl, Ausgewählte physikalische Schülerübungen, Figs. 8—10), Figure 2.15.0

- 83 024. **Diffraction Grating with Holder**, Figure 0.18.0

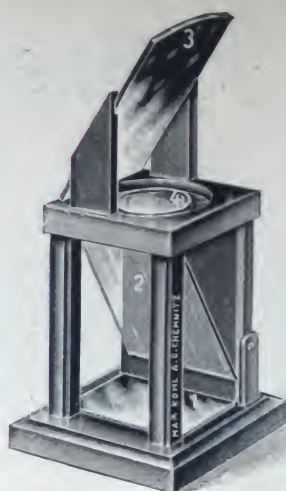
- 83 025. **Screen with Ground Glass, Red and Blue Discs** (Ztschr. f. d. phys. u. chem. U. **20**, 1907, p. 218), for the simultaneous observation of the interference bands for red and blue light, Figure 2. 0.0

Transparent Copies of a genuine Rowland Grating on Plate Glass, Figure, in Case.

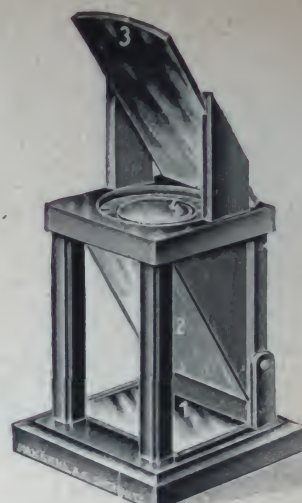
- | | | |
|---------|-----------------------------|--------|
| 83 026. | Area of grating, 25 × 20 mm | 0.18.0 |
| 83 027. | " " " 50 × 35 mm | 1. 4.0 |
| 83 028. | " " " 75 × 50 mm | 2. 8.0 |



54599. 1:7.



54612A. 1:3.



54612B. 1:3.



54613a. 1:8.



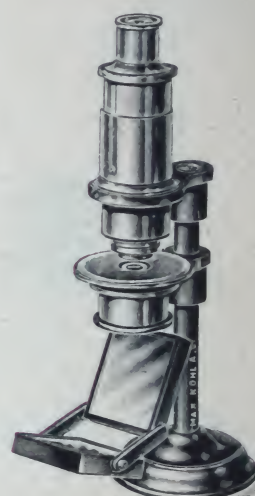
54613b. 1:8.



54613c. 1:6.



54613d. 1:6.



54618.

Polarisation of Light.

54599. **Demonstration Polarisation Apparatus**, direct vision, after Grimsehl, arranged for inserting preparations (Ztschr. f. d. phys. u. chem. U., 18, 1905, p. 325, 326, Fig. 6), Figure . . . £ s. d.
1.10.0

This apparatus consists of two movable polarisers No. 54594 connected together, one of which acts as an analyser. It is possible to demonstrate objectively with them the ordinary phenomena of polarisation by using a projection lantern and a transparent screen No. 51003.

54612. **Simple Polarisation Apparatus** after Hartl, Figures A and B, with wood stand, for taking preparations, and in particular the rapidly annealed glasses No. 53863 (Fr. phys. Techn. II, 2, Fig. 2954), Description . . . 0.10.0

54613. **Polarisation Apparatus for Students' Use**, after Grimsehl, (Grimsehl, Ausgewählte physikalische Schülerübungen, pp. 19-31), Figure . . . 4. 0.0

(a) **Vertical and inclined glass plate** with bases and **Glow Lamp Holder** on base for measuring the angle of polarisation on glass plates (£ 0.7.0); (b) **Polarisation Apparatus with 2 inclined black glass plates**, with preparation holder, for investigations between parallel polarisers (£ 0.4.0); (c) **Polarisation Apparatus with crossed polarisers**, with preparation holder (£ 0.4.0); (d) **Polarisation Apparatus** arranged on Nörrenberg's principle, with rotary set of glass plates (£ 1.10.0); (e) **Preparations** suitable for above: calc-spar, aragonite, gypsum plate 2 mm thick, gypsum plate 0.5 mm thick, gypsum image, butterfly (£ 1.15.0).

54618. **Microscopic Polarisation Apparatus**, Figure (M. P. II, 2, Fig. 802 [II, 1, 763]), with draw tube and lens system, for magnifying the axial images . . . 8. 0.0

The apparatus possesses a very large field of view and permits of viewing simultaneously the poles of the rings in sodium hyposulphite.



83 029.

Polarisation Apparatus for Technical Purposes.

Half-shadow Polarimeters with Divided Circle.

- 83 029. **Mitscherlich's Polarisation Apparatus**, Figure, with **Divided Circle** and Laurent's Polariser, for testing urine for dextrose £ s. d.
11.10.0

Divided circle graduated in whole degrees, vernier reading 0.1°, 2 observations tubes 189.4 and 94.7 mm length. Insertion tube with protecting cover. When using the 189.4 mm long tube, the angle of rotation measured in degrees indicates direct how many grams of dextrose is contained in 100 ccm of the urine under test.

- 83 030. — idem, for investigations of **Cane Sugar** in beet sugar juices, molasses, and the like 11.10.0
With two observation tubes of 150.5 and 75.3 mm in length. When using the 150.5 mm tube, the observer gets directly the percentage of cane sugar in the test solution.

Half-Shadow Polarisation Apparatus, after Lippich, on **Pillar Stand** with stiffened intermediate supports, medium-size pattern, with free divided circle in $\frac{1}{2}^\circ$, reading by vernier to $\frac{1}{50}^\circ$, with Lippich polariser.

- 83 031a. — idem, for observation tubes to **220 mm in length**, without observation tubes . . . 29. 5.0
83 031b. — idem, for observation tubes to **400 mm in length**, without observation tubes . . . 31. 5.0
— idem, on **Block Stand**.

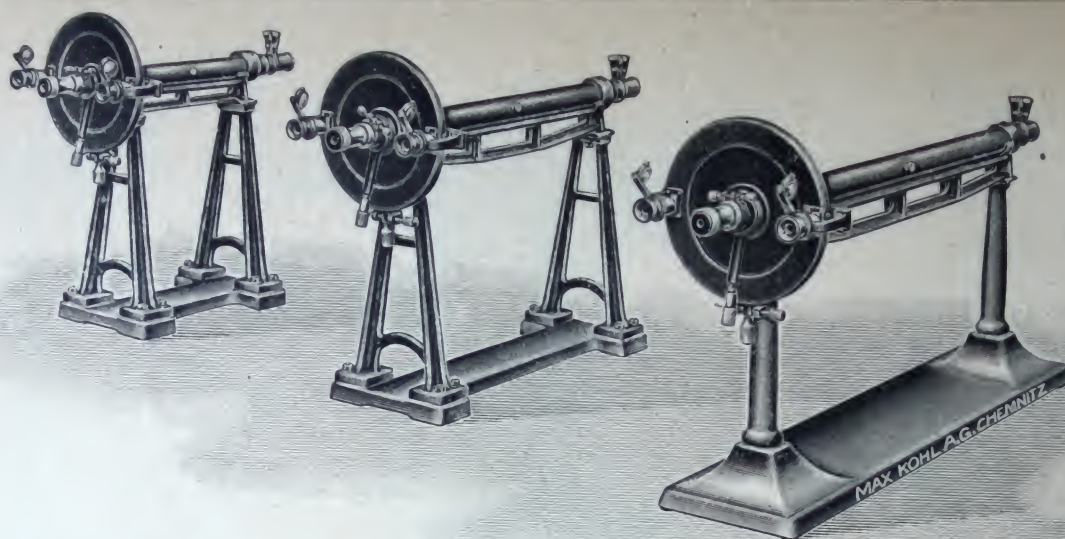
- 83 032a. — idem, for observation tubes up to **220 mm length**, without observation tubes . . 33. 5.0
83 032b. — idem, for observation tubes up to **499 mm in length**, without observation tubes . 37. 0.0

- 83 033. **Extra Price** for fitting the above four apparatus with **Triple Polariser** after Lippich . . 6.10.0

Half Shadow Polarisation Apparatus after Lippich, **Large Pattern**, Figures on p. 1478, on **Block Stand** and stiffened intermediate supports.

The apparatus includes filter, illuminator comprising positive and negative lens, with circle graduated in $\frac{1}{4}^\circ$, having vernier (with protector) reading to $\frac{1}{100}^\circ$ by two magnifying glasses; Lippich polariser; reading telescope with worm adjustment.

- 83 034a. — idem, Figure on p. 1478, for observation tubes up to **220 mm in length**; without Observation Tube 42. 5.0
83 034b. — idem, Figure on p. 1478, for observation tubes up to **400 mm in length**; without Observation Tube 44. 0.0
83 034c. — idem, Figure on p. 1478, for observation tubes up to **600 mm in length**; without Observation Tube 46.15.0
83 035. **Extra Price** for fitting the above three instruments with Lippich triple Polariser . . 6.10.0



83 034 a. 1:10.

83 034 b. 1:10.

83 034 c. 1:10.



83049.

Observation Tubes with extension for collecting air bubbles.

List No.	83 036	83 037	83 038	83 039	83 040	83 041	83 042
Length, mm	94,7	100	189,4	200	220	400	600
£	0.13.0	0.13.0	0.13.6	0.13.6	0.13.6	0.13.6	0.16.8

83 043. **Extra Price** for fitting above with ordinary or thermometer tube, 10 %.83 044. **Cover Glasses for Observation Tubes.** Price per dozen, according to diameter £ 0.4.6 to 0.7.0**Light Sources for Polarimeters.**83 045. **Gas Sodium Burner**, on stand, adjustable for height, with screening cylinder and collapsible sodium salt holder (porcelain)

1.14.0

83 046. **Spirit Sodium Burner**, of same design as above

2. 5.0

83 047. **Platinum Ring** instead of the porcelain container for the two above burners. Price according to prevailing price of platinum

1. 6.3

83 048. **Sodium Chloride**, anhydrous, 100 grams

0. 1.6

Half-shadow Polarimeters with Wedge Compensator.83 049. **Polarisation Apparatus with short Quartz Wedge Compensator**, Figure, after Jellet-Cornu, double field of view, protecting casing for wedge compensator, **Percent Scale** for Dextrose and Albumen, from 15,5 to 20,5 %. Vernier reading to $\frac{1}{10}$ % by magnifying glass, with two observation tubes 200 and 100 mm length

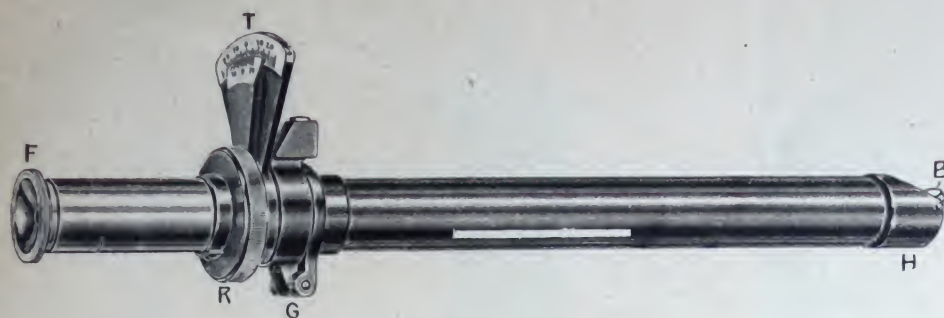
19.15.0

83 050. — idem, with **Ventzke Scale** for directly reading the percentage of cane-sugar to 0,1 %. Scale from - 35,5 to + 50,5 V., with two observation tubes as required

19.15.0

83 051. — idem, with graduation in degrees of arc from - 15,5 to + 20,5 °, for investigations of substances whose rotation-dispersion differs little from that of quartz. Reading $\frac{1}{10}$ °, with two observation tubes after Choice

19.15.0



83056.



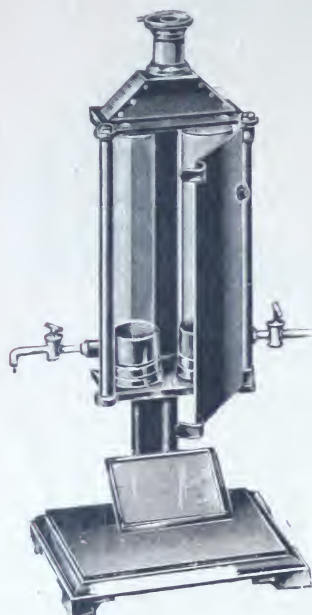
83057. 1:6.

Sources of Light for Wedge-Compensation Polarimeters.

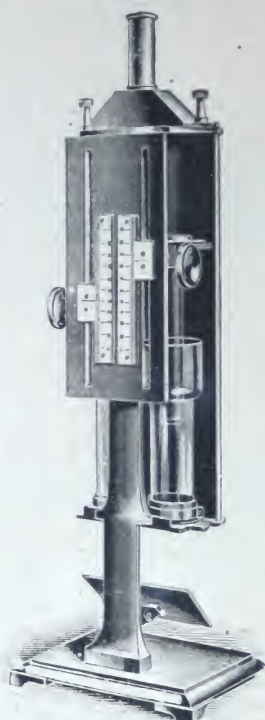
	£ s. d.
83052. Paraffin Lamp (Hink's), adjustable vertically, with screening cylinder, on stand	1. 0.0
83053. Gas Lamp with Argand Burner and protecting cylinder, on adjustable stand	1. 1.0
83054. Gas Lamp with transverse burner and screening cylinder, on adjustable stand	1. 4.0
83055. Spirit Incandescent Lamp with protecting cylinder on adjustable stand	2. 0.0
83055a. Electric Glow Lamp with frosted bulb, on adjustable stand, with flex, and plug-contact	1.15.0

Saccharimeters.

	£ s. d.
83056. Hand Saccharimeter , Figure, with scale from + 20 to - 20°, for determining dextrose and cane sugar , reading by vernier to $\frac{1}{10}^\circ$, glass tube of suitable length with screwed attachment, complete, including observation tube as required	7.10.0
83057. Hand Saccharimeter with fixed Stand , Figure, half-shadow instrument with Laurent plate, divided circle reading directly in percentage saccharine to 15%; vernier reading to $\frac{1}{10}^\circ$; for natural and artificial light. Without Observation Tube	7.15.0
83057a. Observation Tube with extension at one side for collecting air-bubbles, 94,7 mm length	0.13.0
83057b. — idem, 189,4 mm length	0.13.6



83058.



83059.



83060.



83061.

Colorimeters.

83058. **Colorimeter** after C. H. Wolff, Figure, on Iron Base £ s. d.
6.15.0

83059. **Colorimeter**, Duboscq's or Laurent's, Figure 7.10 0

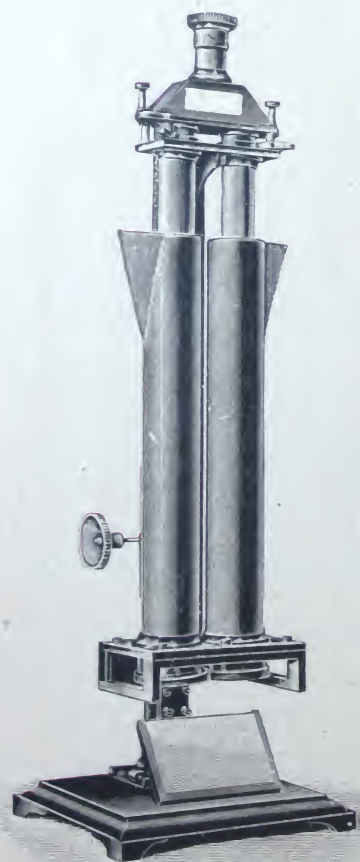
The level of the liquid columns is varied by means of immersion cylinders and is read off on a scale on the stand. Length of scale 100 mm. The movement of the immersion cylinder is effected by rack-and-pinion.

83060. **Colorimeter**, Stammer's, Figure, on **Wood Stand** 10. 5.0

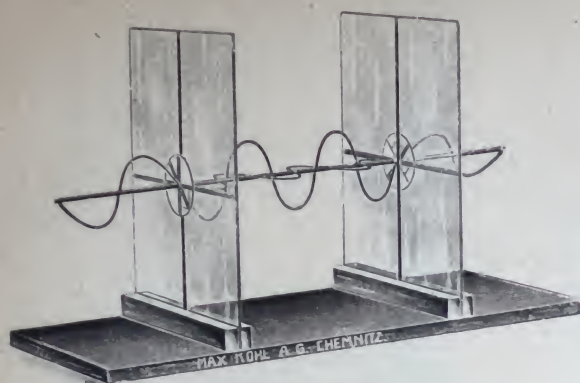
This instrument is used for investigation on **sugar solutions** and **petroleum**, it has only one vessel with immersion tube, but is fitted with a uranium glass plate on the other side. The immersion tube is fixed, and the vessel capable of up and down movement. Length of graduation = 200 mm.

83061. **Colorimeter**, Stammer's, Figure, **entirely of Metal**; height of lift = 260 mm, with **four Normal Glasses** for **Sugar Juices** 11.15.0

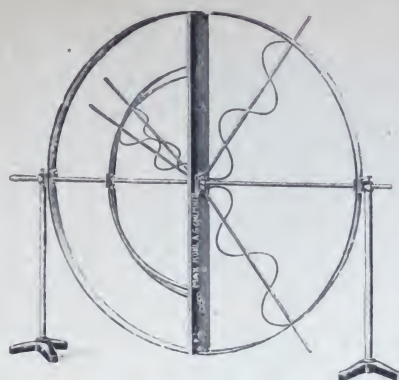
83062. **Colorimeter**, Stammer's, Figure, **entirely of Metal**; height of lift = 320 mm, **Scale with Vernier**, for **Petroleum** 13. 0.0



83062.



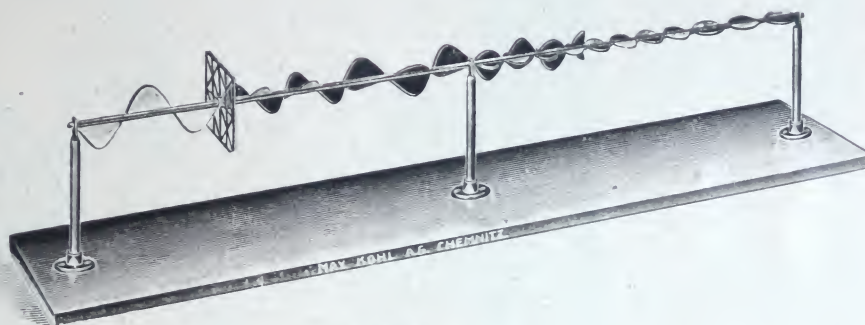
54686. 1:12.



54687. 1:10.



83064. 1:10.



83063. 1:10.



83065. 1:10

Double Refraction of Light.

54686. **Model of a Gypsum Membrane**, after Grimsehl, for explaining the **formation of colour** by polarisation in double-refracting substances (Ztschr. f. d. phys. u. chem. U. 18, 1905, p. 326, 327 Fig. 7), Figure £ s. d.
1.10.0

Between two glass discs representing the bounding surfaces of the Gypsum Membrane, the wave lines of the ordinary (red) ray having $2\frac{1}{2}$ vibrations and of the extraordinary (blue) ray having 3 vibrations are fitted in the form of sine-shaped pieces of wire. The phase displacement inside the membrane is thus known. The wire waves represented on the outside are arranged to rotate. The manner in which the luminous ray is split up is indicated on cardboard discs.

54687. **Model shewing the passage of converging polarised Light through a Calc-spar Plate cut perpendicular to the optical axis**, after Grimsehl (Ztschr. f. d. phys. u. chem. U. 18, 1905, p. 328, Fig. 8), for explaining **colour formation** and the **Calc-spar Cross**, Figure 3. 0.0

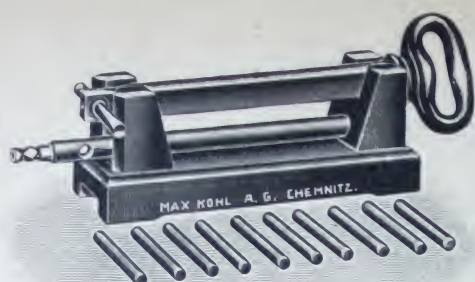
It is possible to show that a calc-spar plate, cut perpendicular to the optical axis, and inserted in a polarised pencil of light has no influence whatever on the nature of the polarised light in a vertical and horizontal plane, while with an incident angle of 45° those portions of the light are extinguished (in the case of parallel polarisers) in which the phase displacement amounts to $\frac{1}{2}$ wave length; on the other hand, however, those luminous rays in which the phase displacement amounts to one-quarter or a whole wave length pass through without interference.

83063. **Crystal Plate with 3 Wave Models**, for demonstrating **Double Refraction** on the passage of waves through an anisotropic medium, like wood, slate, crystal plates (Fr. phys. Techn. II, 2, p. 1267, Fig. 2403), Figure 3.10.0

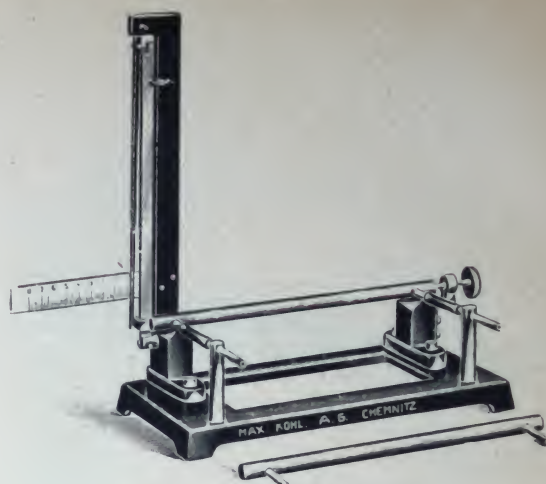
The vertical wave-train entering from the left are split up into two polarised wave-trains parallel to each other, when they enter the crystal plate covered by a framework of wires which intersect and represent the directions of oscillation. The model also demonstrates the passage of these two trains of waves through an analysor, and shows that, inside the crystal the waves are shorter than in the air.

83064. **Model for Explaining Elliptically Polarised Light** (Fr. phys. Techn. II, 2, p. 1301, Fig. 2470), Figure, with a phase-displacement of $\frac{1}{8}\lambda$ 0.12.0

83065. **Model for Explaining Different Polarised Light** (Fr. phys. Techn. II, 2, p. 1301, Fig. 2471), Figure 2. 4.0



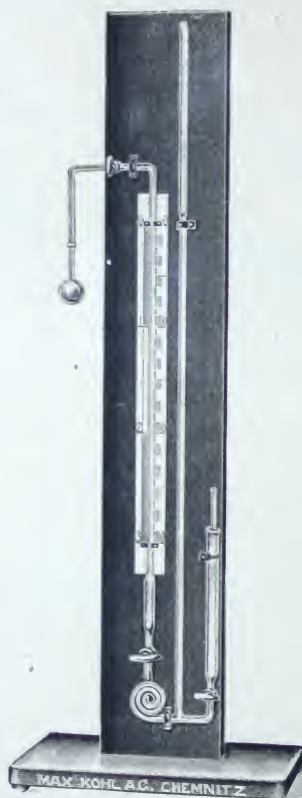
54795. 1:8.



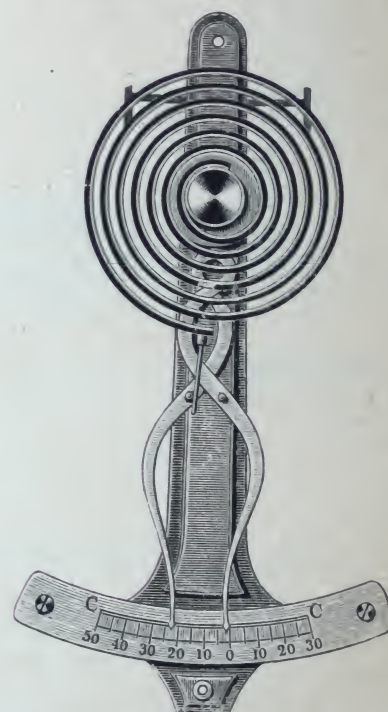
83066 1:7.



83067. 1:9.



54910. 1:10.



54894. 1:3.

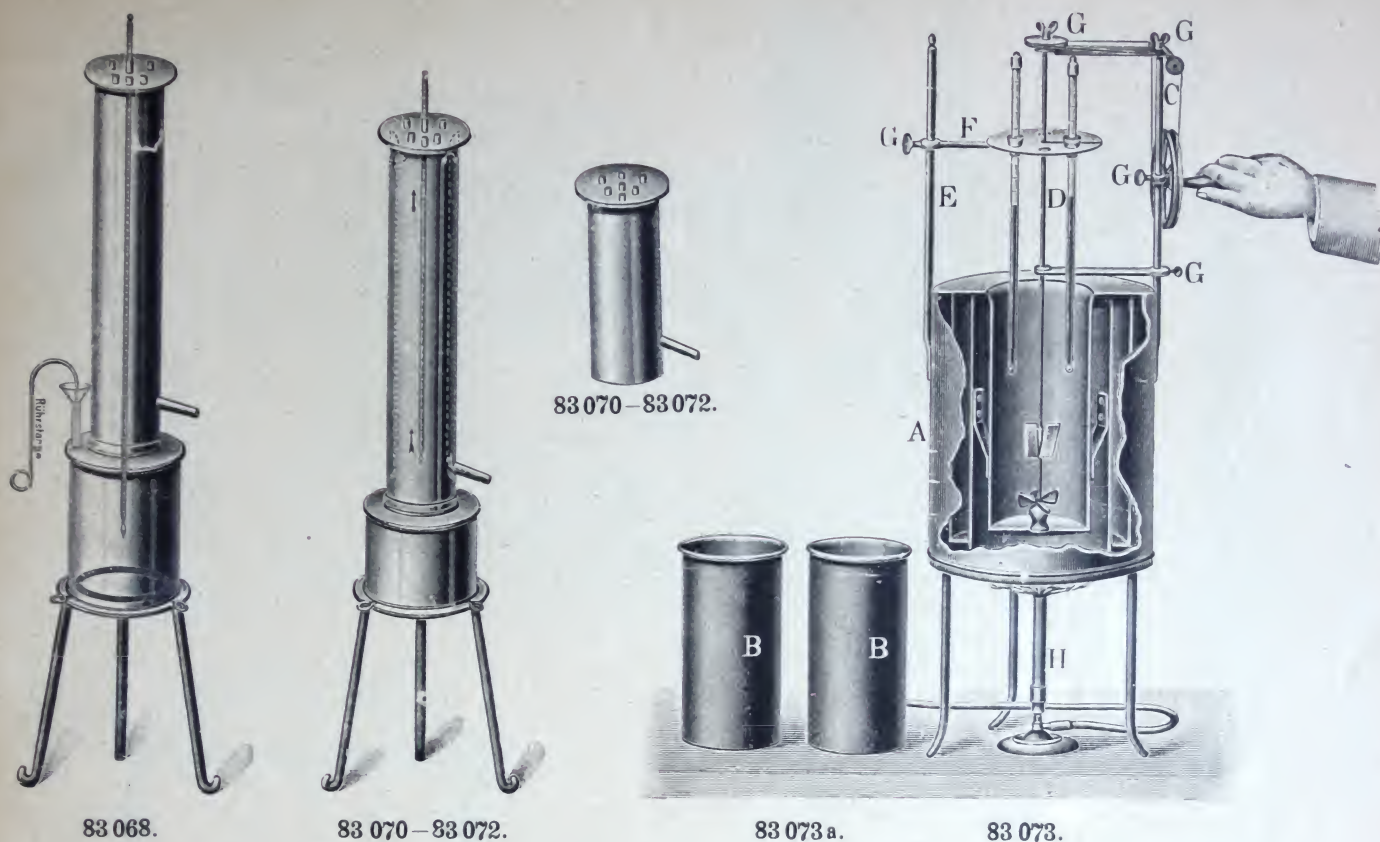
Max Kohl, Aktiengesellschaft, Chemnitz, Germany.

Heat.

Expansion by Heat, Thermometers.

54795. Contraction Apparatus after Tyndall, Figure, for demonstrating expansion by heating and the elementary force by contraction on cooling (M. P. II, Figs. 34 and 35 [II, 2, Figs. 32 and 33]), with 12 Cast Iron Bars	£ s. d. 0.14.0
A 9 mm bar is fractured by the contraction exerted on cooling in the thick square bar. For Bunsen burners and stands for heating, see following items.	
83066. Tube Expansion Apparatus , with 3 tubes, steel, brass and glass, for steam-heating, Figure	1.15.0
83067. Spiral Tube , Figure, of brass with stopper and capillary	0.18.0
54894. Metal Thermometer , Figure, Swiss pattern (M. P. III, Fig. 39 [II, 2, Fig. 38]), with maximum and minimum pointers. Very reliable	1.16.0
54910. Self-Correcting Air Thermometer after Prof. C. G. Müller; simplified Pattern , Figure, with very plain scale in single degrees, each degree about $\frac{1}{2}$ " long. (M. T., Fig. 97)	2. 2.0

Cl. 6208, 6244,
6795, 6634, 6624.



Thermometer Testing Apparatus.

83 068. **Thermometer Test Apparatus, (Boiling Apparatus),** Figure, with two attachments 20 and 25 cm high, for point-determination of thermometers, complete £ s. d. 1. 17. 6

83 069. **Head (Attachment):** height, mm 250 500 750
Price each £ 0. 10. 0 0. 13. 6 0. 17. 0

Thermometer Test Apparatus, (Oil-Boiling Apparatus), Figure, for temperatures to 250° C. with Heads.

List No.	83 070	83 071	83 072
Height, mm	250	500	750
Price £	2. 10. 0	2. 16 0	3. 5. 0

The apparatus, of copper throughout, has detachable heads. It is double walled, sheathed with asbestos, and with **stirrer** for ensuring uniform temperatures.

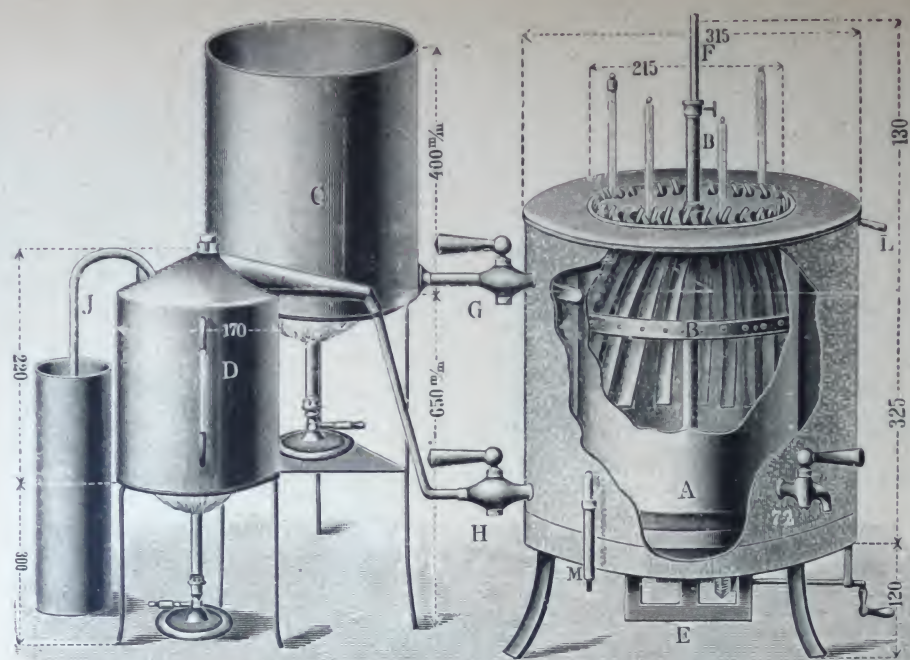
83 073. **Thermometer Test Apparatus, Figure, for low and high temperature work, complete, without Bunsen burner** 7. 10. 0

The **jacket A** is triple-covered with asbestos; enamelled **Pots B** for water, oil, and saltpetre; **Stand C** with wheels; **Vertical Shaft D** with stirrers; **second Stand E** with adjustable **Disc F** for inserting the thermometers.

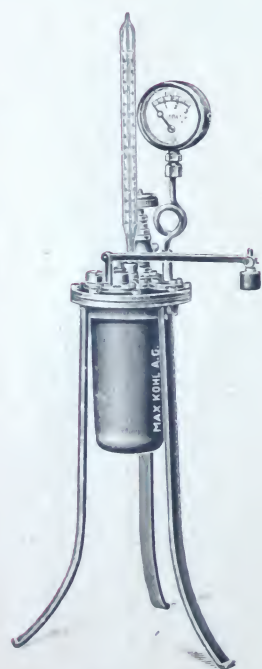
83 073a. **Enamelled Pots, each** 0. 8. 0

83 074. **Precision Thermometer Testing Apparatus, Figure page 1484, Description** 20. 5. 0

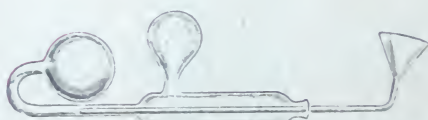
Comprising double-walled **Vessel A** (rustless), felt-jacketted, two run-in cocks, overflow pipe and waste cock; **Stand B**, brass, for 21 thermometers; **Hot Water Pot C** of stout copper sheet, with tripod; **Steam Generator D**, of thick sheet copper, with water-gauge.



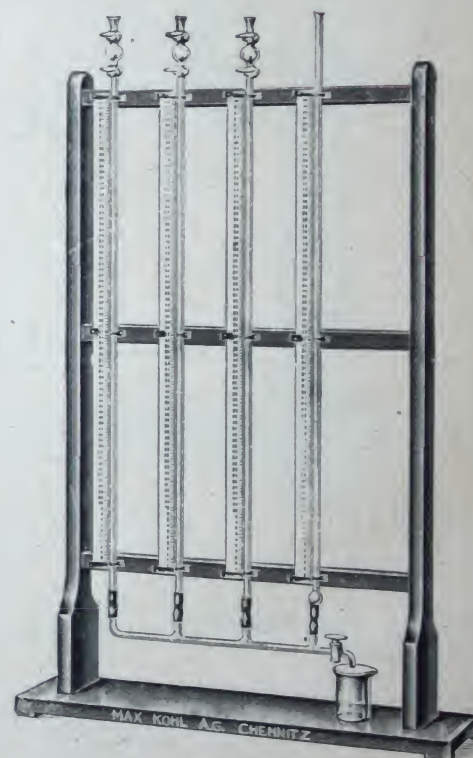
83 074.



55 070. 1:10.



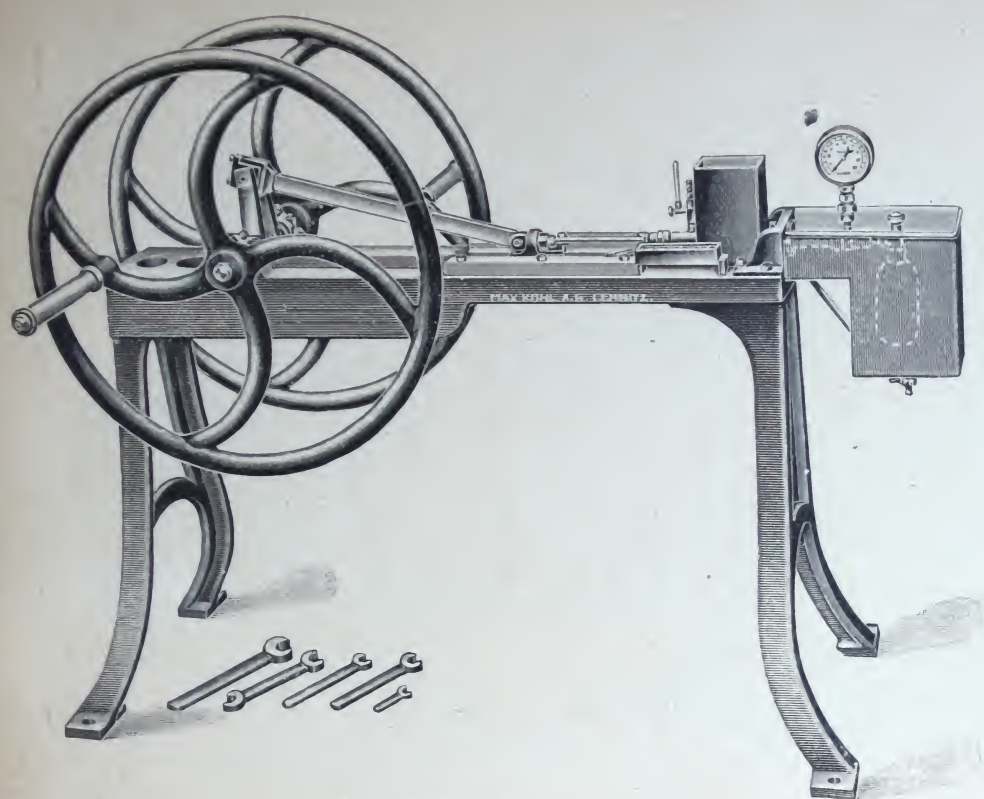
55 087. 1:9.



83 075. 1:13.

Changes of State.

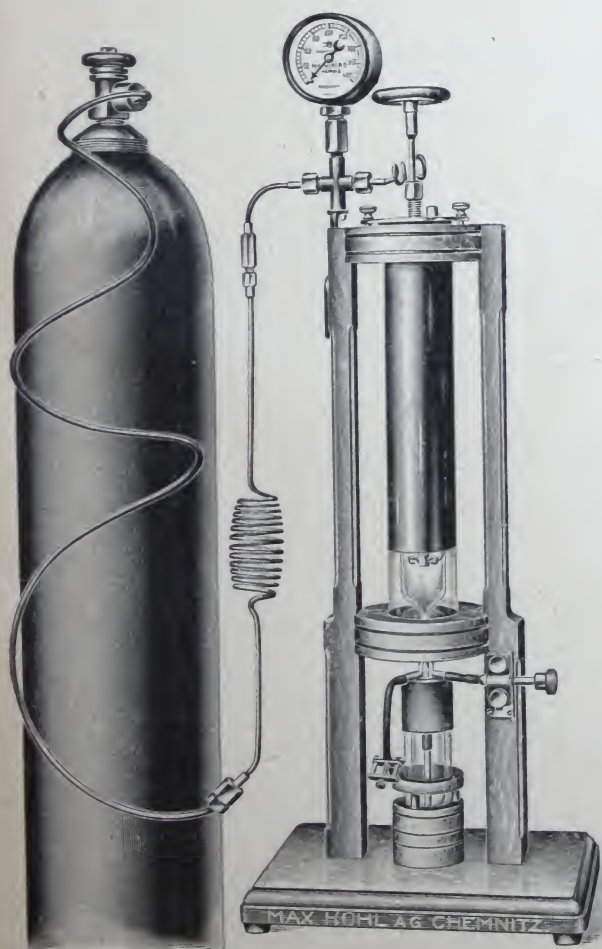
- | | |
|--|----------|
| 83 075. Apparatus for Demonstrating the pressure of saturated Vapours, after Meissner, Figure, comprising 4 communicating tubes, three of which each have 2 glass stopcocks on top | £ s. d. |
| | 3. 10. 0 |
| The tube without the tap is used for filling the apparatus with mercury. All four tubes have funnel-shaped mouths for inserting the mercury or the liquids to be evaporated. This apparatus prevents air bubbles getting into the vacuum, and only the small amount of mercury in direct contact with the liquids requires cleaning. (Ztschr. f. phys. u. chem. U., 25, 1912, p. 222). | |
| 55 070. Papin's Digester, of brass, on tripod, for 1½ atmospheres, with safety valve, thermometer and Spring Manometer 70 mm diameter, Figure | 2. 8. 0 |
| 55 087. Sulphuric Acid Cryophorous after Weinhold, Figure (W. D., Fig. 394 [374]), with funnel for filling | 0. 4. 0 |



83076. 1:7.



83077 et 83078b. 1:8.



55103 et 83078b. 1:7.

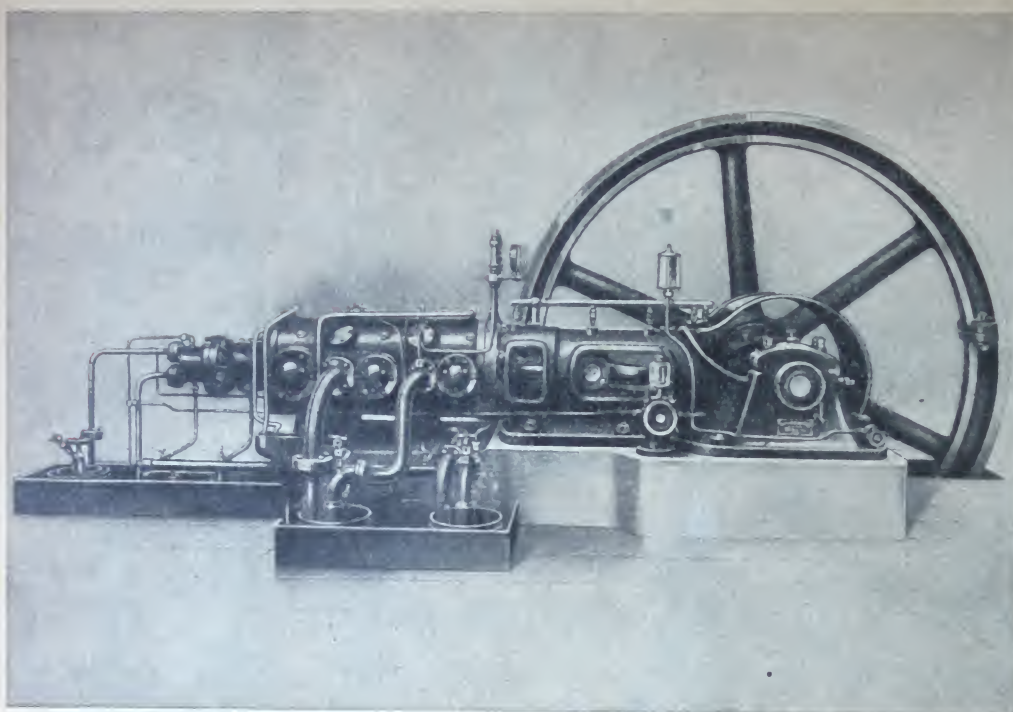
83076. **Apparatus for Compressing Carbonic Acid and other Gases**, as suggested by Natterer, Figure, Horizontal type, for 75atmos. Underframework entirely of iron; steel cylinder, with two flywheels; with spanners. Bottle holding 1 kg, tested to 125 atmos.; cooling vessel and spare packings £ s. d. 35. 0.0

83077. **Simple Lecture Apparatus for the Liquefaction of Air and Oxygen**, Figure, including pressure gauge; without steel bottle 12.10.0

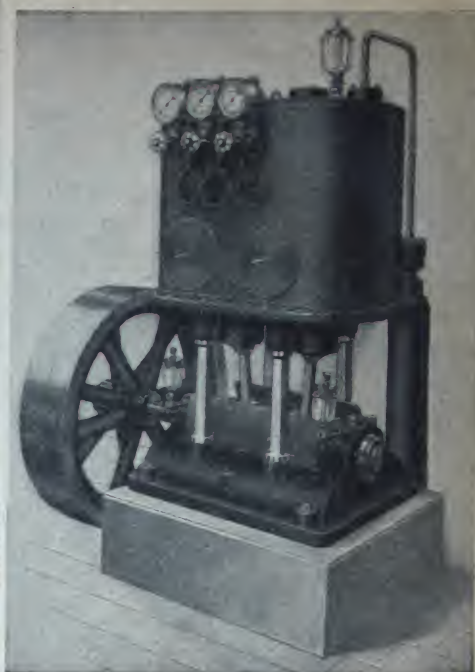
55103. **Demonstration Apparatus for Generating Liquid Air after Olszewski**, Figure, without steel bottle, **Description** . . . 31. 0.0

83078a. **Steel Bottle**, holding 25 litres, with Dräger valve, officially tested to 300 atm., filled with air at a pressure of 200 atm. 3.15 0

83078b. **Steel Bottle** holding 35 litres, with Dräger valve, officially tested to 300 atm., filled with air at 200 atm., Figure . . . 4.10.0



83159.



83161.

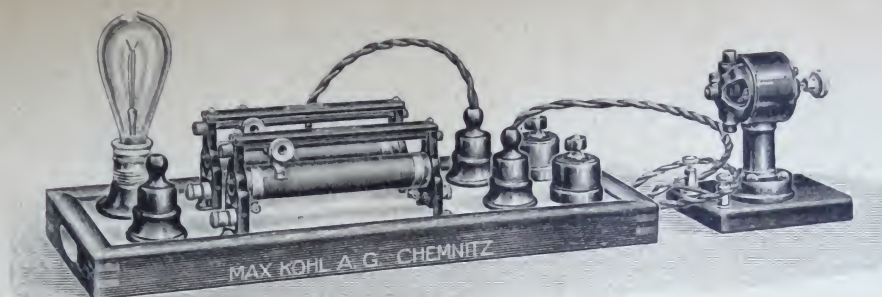
Compressors.

For the **liquefaction** of larger quantities of **air** or **oxygen**, compressors are necessary, and these we can supply of approved design. The prices of compressors with accessories are subject to a certain amount of fluctuation. When ordering compressors which it is intended to use for oxygen as well as air, this should be particularly stated. Unless we are informed to the contrary, we shall supply the compressors for air only.

83159. Laboratory Air Compressor , Figure, horizontal, belt-driven type, three-stage	£ s. d. 153. 0 0
With Flywheel 29 ins. diam., 4 ins. wide; Inter-Cooler , Pressure Gauge , Safety Valves , the necessary lubrication gear and hold-down fittings, including all accessories.	
The compressor, having a stroke of 100 mm (4 ins.), and cylinders 80, 46, 18 mm diameter, normal speed 100, max. speed 150 r. p. m., can absorb normally 3,6 cubic metres and a maximum of 5 cbm. of air at atmospheric pressure, and compress this to a maximum of 5 atmospheres pressure. The normal power required for doing this is 12 HP., measured at the compressor-shaft, and the max. HP., 1,75.	
83160. Electric Motor for above, for 110 or 220 V. Direct Current ; delivering 2 HP., with Starter and Tension Rails , but without belt	13 10.0
83160a. — idem, for Three-phase Current	10.15.0
83161. High-Pressure Compressor , Figure, for belt drive; vertical, three-stage type	166. 5.0
With flywheel 29 ins. diameter and 3½ ins. wide, Safety Device for Crank , Cooler , Pressure Gauge , Safety Valves , Oil Separator and the necessary Lubricating Gear and Holding Down Fittings .	
This compressor, with 75 mm stroke and cylinders 105, 55, and 22 mm diameter, and running at a normal speed of 280 and a max. speed of 375 r. p. m., is capable of dealing with a normal delivery of 12 cbm and a max. delivery to the compressor of 16 cbm of air per hour at atmospheric pressure, and compressing it to final pressures of 200 atmospheres. The power required, as measured on the compressor shaft, is 4,8 HP. (normal) and 6,4 HP. (maximum).	
83161a. Electric Motor for above, for 110 or 220 V. Direct Current ; output = 7,5 HP., with Starter and Tension Rails ; without belt	27.15.0
83161b. — idem, for Three-phase Current	21.10.0
83162. High-Pressure Purifier , suitable for all sizes of compressors; absolutely necessary	9.15.0
83163. Low-Pressure Purifier , suitable for all sizes of compressors; absolutely necessary	12. 0.0

Estimate of Cost

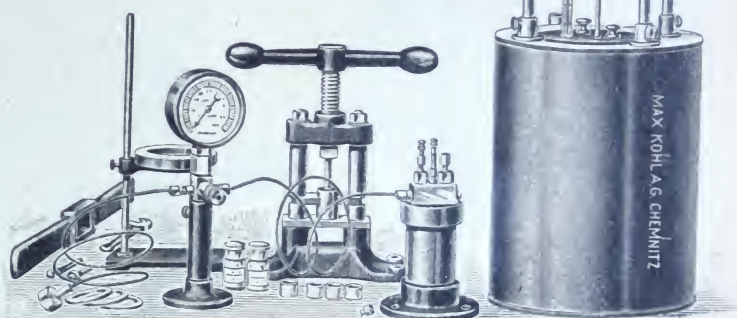
of a Plant for Liquefying large quantities of Air per Hour		and		3 to 4 Litres Liquid Air.	
Giving about 500—600 c. c.					
1 Air Liquefying Apparatus No. 83077	12. 10. 0	1 Air Liquefying Apparatus No. 55103	31. 0. 0	1 High-pressure Compressor No. 83161	166. 5. 0
1 Laboratory Air Compressor No. 83159	153. 0. 0	1 Electric Motor for 110 or 220 V. Direct Current , No. 83160	13. 10. 0	1 Electric Motor for 110 or 220 V. Direct Current , No. 83161a.	27. 15. 0
1 Electric Motor for 110 or 220 V. Direct Current , No. 83160	13. 10. 0	Or idem, for 3-phase current , No. 83160a £ 10. 15. 0		1 High-pressure purifier No. 83162	9. 15. 0
1 High-pressure purifier, No. 83162	9. 15. 0	1 Low-pressure purifier, No. 83163	12. 0. 0	1 Low-pressure purifier No. 83163	12. 0. 0
1 Low pressure purifier, No. 83163	12. 0. 0	10 metres (32 ft. 6 ins.) of copper piping 5×8 mm diam. tested to 400 atm., for connections	2. 10. 0	2 Double-walled glass tubes, silvered, for decanting fairly large quantities of liquid air	1. 2. 0
10 metres (32 ft. 6 ins.) of copper piping 5×8 mm diam. tested to 400 atm., for connections	2. 10. 0	3 High-pressure Cocks	1. 16. 0	10 metres (32 ft. 6 ins.) of copper piping 5×8 mm diam. tested to 400 atm., for connections	2. 10. 0
3 High-pressure Cocks	1. 16. 0	2 Dewar Vessels No. 55111 with stand	0. 14. 0	3 High pressure Cocks	1. 16. 0
2 Dewar Vessels No. 55111 with stand	0. 14. 0	1 Decanting Device	0. 5. 0	3 Dewar Vessels for storing liquid air, with stand, each holding 5 litres	4. 10. 0
1 Decanting Device	0. 5. 0	Packing (for ordinary land transport)	3. 10. 0	1 Decanting Device	0. 5. 0
Packing (for ordinary land transport)	3. 10. 0			Packing (for ordinary land transport)	4. 10. 0
Sa £ 209.10.0				Sa £ 261. 8.0	



71 003. 1:6.



83 079.



71 000. 1:10.

Calorimetry, Calorific Power Determination.

Calorimeters for the Determination of Calorific Power of solid, liquid and gaseous Fuels.

71 000. **Calorimeter** after Berthelot-Mahler-Krocker, Figure, for determining the calorific power of solid and liquid fuels £ s. d.
27.10.0

Comprising: 1 Rust-free Combustion Bomb of Böhler steel, polished inside and out; 1 Support for bomb; 1 Stand for the bomb lid; 3 Combustion Dishes, clay; 1 small quartz combustion dish; Nickelin wire; 2 substances of known calorific power for determining the value of water; 3 spare lead packing rings; 5 keys of various sizes and 1 screwdriver; 1 double-walled copper boiler; 1 nickel-plated Calorimeter vessel, brass; 1 thermometer graduated in $\frac{1}{100}^{\circ}$ C. from 15—24° C. officially tested, with reading device; 1 pressure gauge to 60 atm., on stand, with connection to the oxygen bottle and combustion bomb; 1 pastille press for making the fuel samples for test.

71 001. — idem, with acid-resisting Nickel-bronze Bomb 33. 0.0

71 002. — idem, with Krupp acid-resisting Special Steel Bomb 38.10.0

A detailed description and directions for use are supplied with each calorimeter.

71 003. **Ignition and Stirring Arrangement** after Fuchs, Figure 7.10.0

Comprising: 1 Electric Motor for operating the stirrer gear; 1 switchboard with rheostat; 1 switch; 1 plug-box with plug and cord for the motor; 1 rheostat; 1 pilot lamp; 1 cut-out; 1 plug-box with plug and flex for connecting up with the supply.

When ordering, please state current and voltage of the supply.

71 004. **Collection of Apparatus for Determining the Water-Content in the Burnt Fuel** 5. 0.0

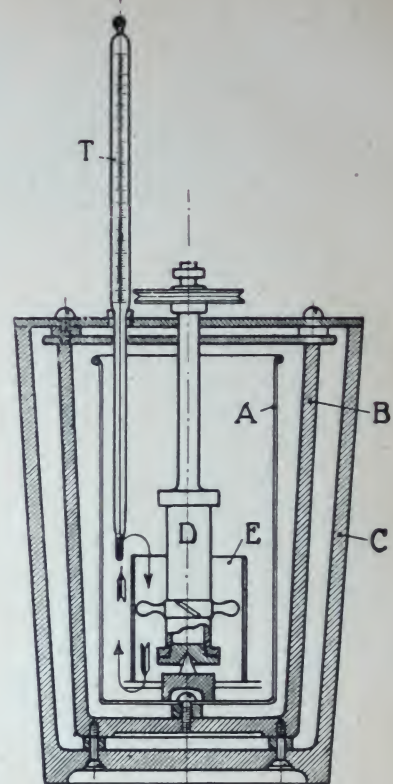
Comprising: 2 Large glass flasks with tubes on the bottom; 1 drying tower for calcium chloride; 1 oil-bath with stand and gas-burner; 1 calcium chloride receiver; 1 beaker with the necessary tubing.

83 079. **Calorimeter** after Prof. Dr. Hempel, for determining the calorific power of fuels. Figure, complete 16. 5.0

Hempel's calorimeter is based on the same principle as the Berthelot-Mahler-Krocker instrument, but the design is greatly simplified.



55194A, 55195 et 55197. 1:7.



55194B. 1:5.

55194. **Calorimeter** after Parr, Figures A and B, for **technical Calorific Power determinations** of fuels; with sieve, reagent bottle with rubber stopper; Measuring Glass; 12 Ignition Rods; Forceps; Magnifying Glass with holder; Spanner for nuts; Brush; and best quality Thermometer divided in $\frac{1}{50}^{\circ}$ C.; but less motor and driving stand

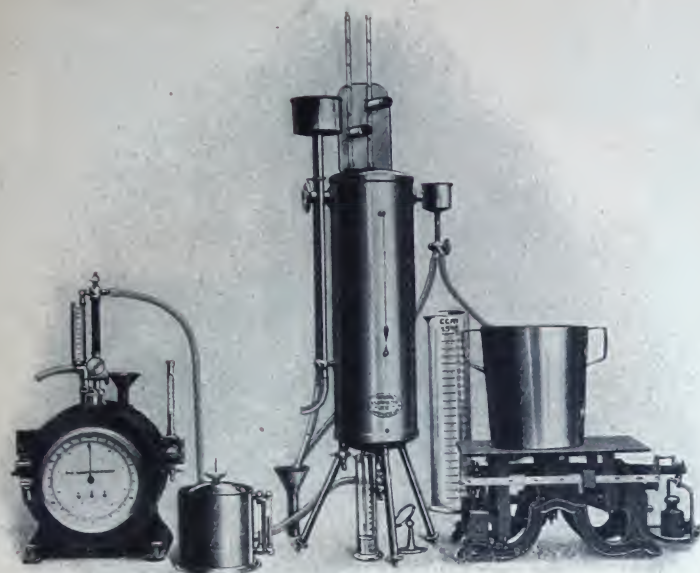
£ s. d.
10. 0.0

The above calorimeter is a convenient, cheap and reliable apparatus for authorities and manufacturers for **comparative determinations** of the calorific power of fuels used, i. e., coal, lignite, coke, etc. The time taken on a **test**, including the necessary weighings, is only $\frac{1}{2}$ hour. No high pressure is used in the apparatus nor is set up by reaction, as an auxiliary reagent gives the oxygen required to support combustion and at the same time combines the products of combustion.

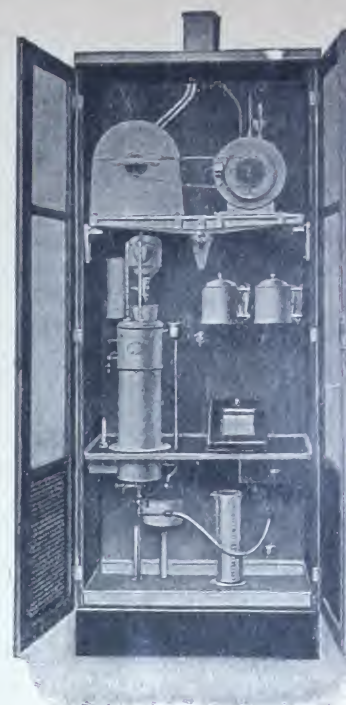
Detailed description and directions for use supplied if desired.

Accessories for Parr Calorimeter:

- | | |
|--|--------|
| 55195. Electric Motor for 110 V. direct current, with stand, Figure | 3.10.0 |
| 55196. Turbine , after Rabe, with driving stand, for connecting to the water-main | 1. 5.0 |
| 55197. Spare Reaction Bulb , Figure | 1.11.0 |
| 55198a. Spare Thermometer , graduated in $0,02^{\circ}$ C., with water value indicated | 1.13.0 |
| 51546b. Chemical and Technical Balance , in glazed walnut case, with arrestment and levelling screws, sensitive to 1 mg and carrying 20 grams | 3. 5.0 |
| 51622. Set of Weights from 1 mg to 20 grams, of brass, gilt | 1. 0.0 |



83080 a.



83080 b.

83080. **Junkers Calorimeter**, Figures a and b, for calorific power determinations of **Gases** and **Liquid Fuels**. Specially designed as a **Hand Measuring Apparatus**.

£ s. d.

Single Parts		a Without Box for storing	b With
A	1 Calorimeter , with burner and nozzles, thermometers 0—40°, divided $\frac{1}{10}^{\circ}$ C., 1 thermometer 0—40°, divided whole degs., 2 reading glasses, 3 rubber stoppers, 3,5 metres of rubber tubing, 1 stand mirror, 1 measuring glass 100 c. c., iditto 2500 c. c., 1 measuring glass about 7 litres, 1 white-lacquered hollow sheet iron vessel, 1 packing ring, 1 box spanner, 1 tommy bar	£ 13. 5.0	£ 15.10.0
B	1 Gas Meter to 5 litres, with fine adjustment cock, 1 thermometer 0—40° C., divided whole degrees	7. 5.0	9. 5.0
C	1 Gas Governor , with 6 loading plates	1.17.0	2.18.0
D	1 Auxiliary Arrangement for liquid fuels, comprising 1 precision balance, 1 evaporation lamp with counterweight, 3 spanners, 1 air-pump, burner nozzles, cleaning needles, packings	7. 5.0	—.—
E	1 Calibrating Device for Gas Meter, comprising 1 glass calibrating flask, 1 litre; 1 stand, 1 water vessel, 1 metre rubber tubing	2. 7.0	—.—
The entire apparatus comprises following parts:			
A—C	For gases only	22. 7.0	27.13.0
A—D	For gases and liquid fuels	29.12.0	34.18.0
A+D	For liquid fuels only	20.10.0	22.15.0

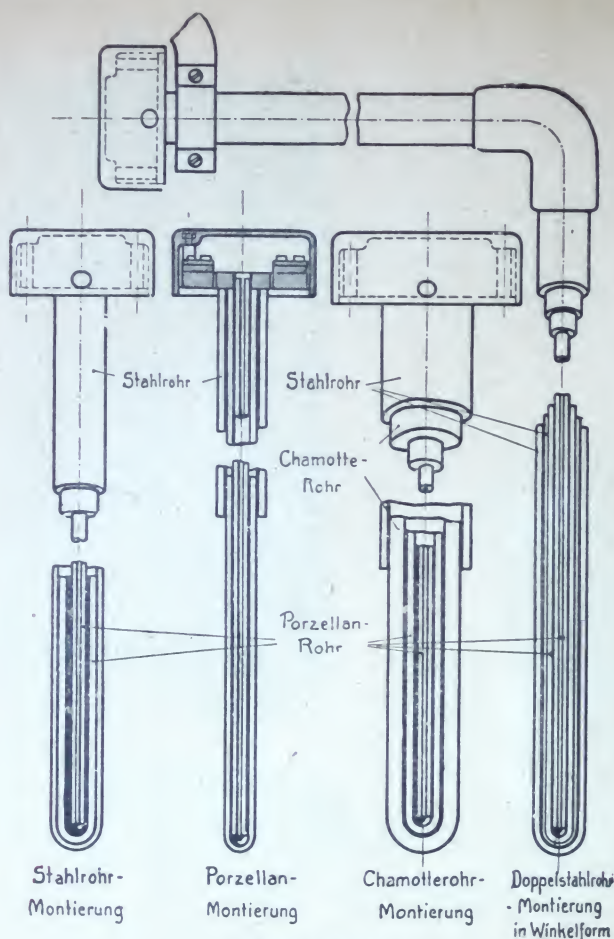
83081. **Automatic Calorimeter** (Junkers'), for the continuous determination and recording of the calorific power of **Gases**

67.10.0

The calorimeter consists of 1 calorimeter with inbuilt thermopile, 1 coupled gas and water meter with float governor, 1 gas-pressure governor for inlet and outlet, 1 apparatus cupboard with leads and connections, unglazed; 1 float case, 2 thermometers 0—40° C. in $\frac{1}{10}^{\circ}$ C., two ditto 0—40° C. in whole degrees, 2 reading glasses, 5 rubber stoppers, 3 measuring vessels, 1 white-lacquered sheet iron vessel, and 1 precision indicating galvanometer.

83082. — idem, with 1 precision recording galvanometer

96.10.0



83 083—83 130.



82 131.



82 132.



82 133.

Pyrometers.

Thermo-Electric Pyrometer after Le Chatelier, for temperatures between 300°—1600° C. (according to type of mounting used), consisting of a thermo-couple with two wires of platinum and platinum-rhodium in special protection mounting.

Thermo-Couples Mounted ready for use, consisting of two platinum and platinum-rhodium wires. These prices are subject to fluctuation owing to variations in the price of platinum.

Thickness of Thermo-couple	Length of Mounting	Steel Tube Mounting		Porcelain Tube Mounting		Fire-clay Tube Mounting		Double Steel Tube Mounting	
		List No.	£	List No.	£	List No.	£	List No.	£
0,6	130	83083	22. 5.0	83095	22. 5.0	83107	24.10.0	83119	—
0,6	100	83084	17.15.0	83096	17.15.0	83108	19.10.0	83120	19. 0.0
0,6	80	83085	14.15.0	83097	14.15.0	83109	16.10.0	83121	—
0,6	60	83086	11.10.0	83098	11.10.0	83110	13. 5.0	83122	—
0,5	130	83087	16.15.0	83099	16.15.0	83111	18.15.0	83123	—
0,5	100	83088	13.10.0	83100	13.10.0	83112	15. 0.0	83124	14.10.0
0,5	80	83089	11. 0.0	83101	11. 0.0	83113	12.15.0	83125	—
0,5	60	83090	8.15.0	83102	8.15.0	83114	10.10.0	83126	—
0,4	130	83091	12. 5.0	83103	12. 5.0	83115	14 10.0	83127	—
0,4	100	83092	10. 0.0	83104	10. 0.0	83116	11.15.0	83128	11. 0.0
0,4	80	83093	8. 5.0	83105	8. 5.0	83117	10. 0.0	83129	—
0,4	60	83094	6.10.0	83106	6.10.0	83118	8. 5.0	83130	—

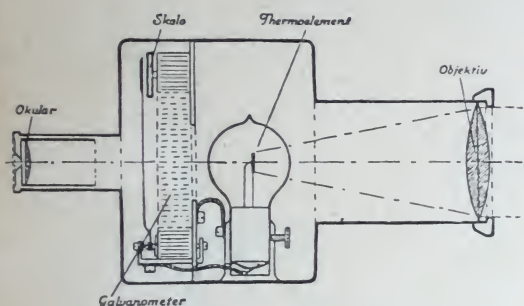
Prices of Thermocouples of non-rare metals on application.

The Steel Tube Mounting, Figure, is suitable for temperatures up to 950° C. The protecting tube and the insulating tube for the thermocouple consist of Marquardt special refractory fireclay. The external diameter of the steel tube is 33 mm.

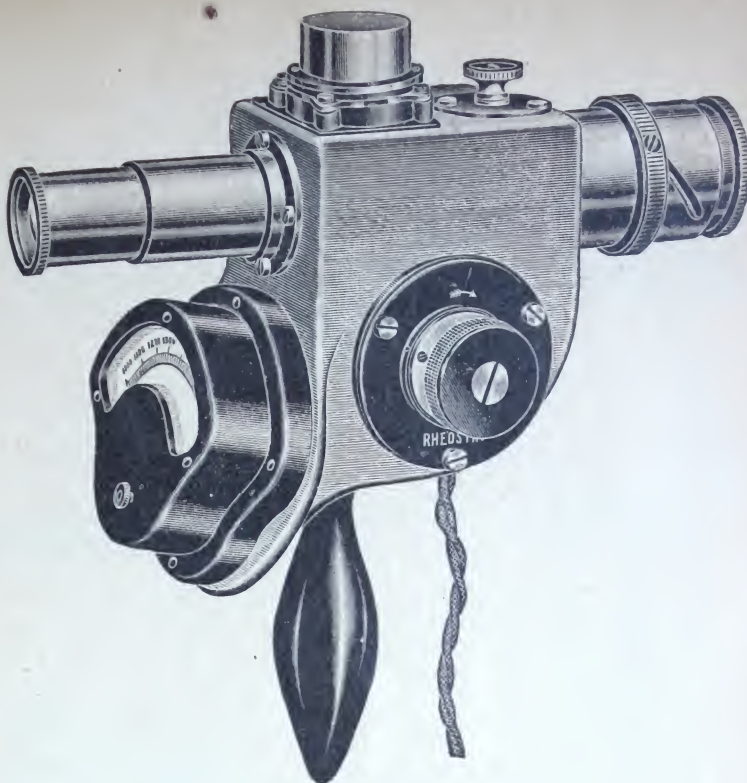
The Porcelain Tube Mounting, Figure, is suitable for protracted measurements up to 1500° C. The protecting tube, of Marquardt fire-clay, projects freely from the iron tube. The diameter of the iron tube is 33 mm, and of the porcelain tube, 17 mm. Any abrupt change of temperature or mechanical stress should be avoided.



83 134 A — 83 138 A



83 134 B — 83 138 B.



83 139.

The Fire-Clay Tube Mounting, Figure, on p. 1489, is suitable for protracted measurements to 1500°C . The protecting tube, of Marquardt refractory fire-clay, is protected throughout its length by a fireclay tube 35 mm diam. This tube stands up to big fluctuations of temperature, but too abrupt changes of temperature and mechanical stressing should be avoided.

The Double Steel Tube Mounting, Figure, on p. 1489, of angular form, is used for measuring temperatures in metal and salt baths to 950°C . Each limb is 50 cm long. The external diam. of the steel tube is 33 mm.

Galvanometers used for Temperature Measurements.

83 131. Temperature Measurer , Figure, p. 1490. This is a table instrument with band system of suspension, with scale from $0-1600^{\circ}\text{C}$	£ s. d. 12. 0. 0
83 132. — idem, Figure, p. 1490, table instrument with point suspension of measuring system, with scale from $0-1600^{\circ}\text{C}$	9. 15. 0
83 133. idem, Figure, p. 1490. Wall instrument, water-tight, with vertical system of axes	8. 0. 0

Radiation Pyrometer, Figs. A and B, portable, for temperature measurements in technical plants. In carrying case.

This instrument consists of a **Thermocouple** and a **high-sensitivity galvanometer**, built into one small case. The measurements are independent of the distance of the heat source from the pyrometer.

83 134. Radiation Pyrometer , range $500-1000^{\circ}\text{C}$	13. 0. 0
83 135. — idem, range $700-1400^{\circ}\text{C}$	13. 0. 0
83 136. — idem, range $800-1600^{\circ}\text{C}$	13. 0. 0
83 137. — idem, with two ranges, $500-1000^{\circ}\text{C}$ and $700-1400^{\circ}\text{C}$	14. 10. 0
83 138. — idem, with two ranges, $700-1400^{\circ}\text{C}$ and $1300-2000^{\circ}\text{C}$	14. 10. 0

83 139. Optical Pyrometer , Figure, for the direct measurement of high temperatures from $700-1600^{\circ}\text{C}$, in carrying case and with self-contained electric supply	16. 5. 0
---	----------

This apparatus is based on Holborn-Kurlbaum's principle, according to which the brightness of filament of a small glow-lamp is compared with the brightness of the incandescent body whose temperature is to be measured. The setting is to equality.

83 140. idem, range $1500-3500^{\circ}\text{C}$, in Carrying Case and with self-contained source of current	16. 5. 0
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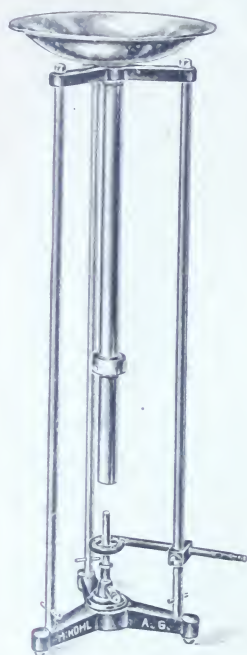
55165 et 55166. 1:6.



55164. 1 5.



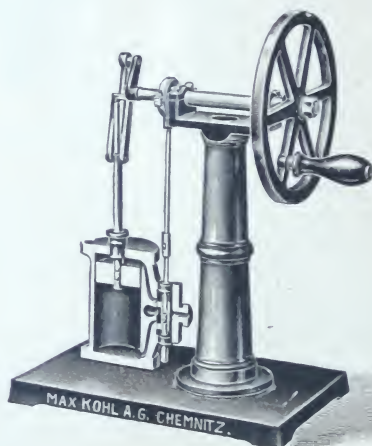
55168a. 1:8.



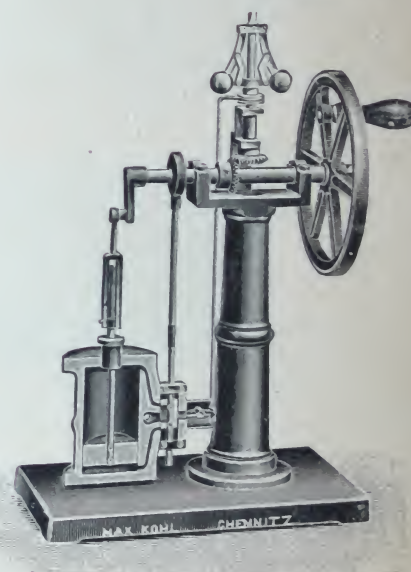
55246. 1:12.



83141. 1:18.



55252. 1:7.

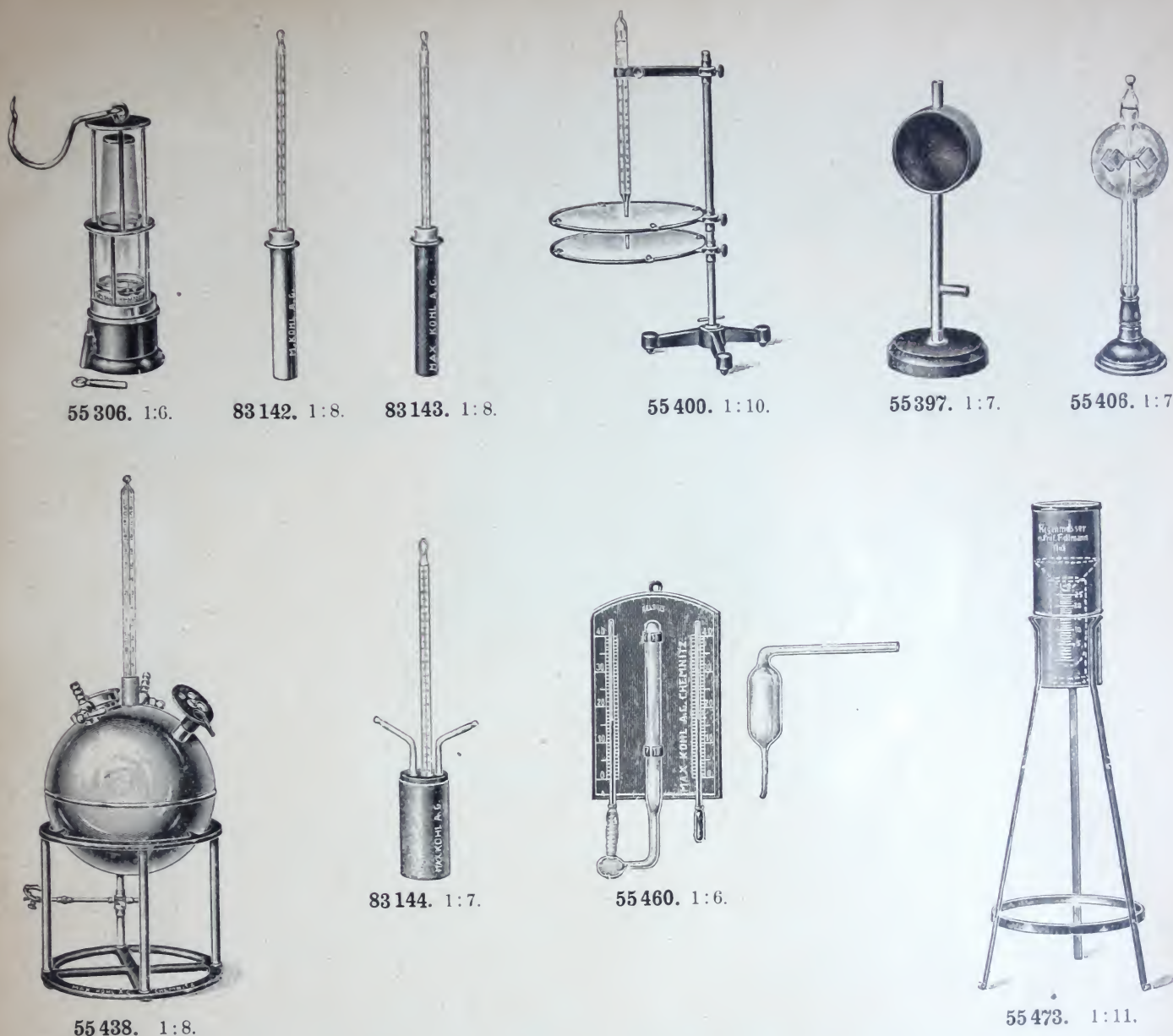


55253. 1:7.

Specific Heat and Heat Engines.

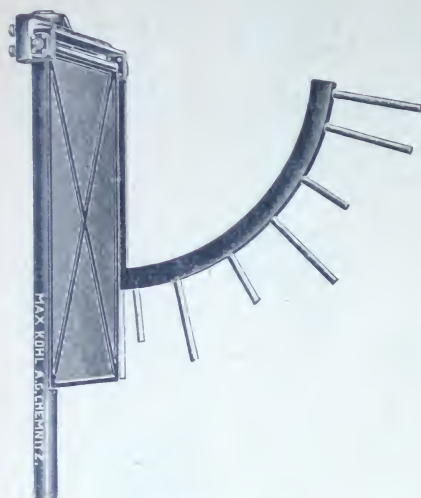
55164. Semi-Cylindrical Bent Plates with lugs, of lead, copper and iron, with boiling vessel for 1 kg of mercury, for determining specific heat by the mixing method (M. T., p. 148), Figure	£ s. d. 0. 12. 0
55165. Calorimeter Vessel after Friedr. C. G. Müller (M. T., Fig. 98), containing 1,2 litres, Figure	0. 10. 0
55166. — idem, containing $\frac{1}{4}$ litre, Figure	0. 8. 0
55168a. Water Trap for 55167, for keeping water of condensation from the calorimeter on the experiment on the latent heat of vapour (W. D., Fig. 189 [369]), Figure	0. 5. 0
83141. Whiting's Tube , Figure, pasteboard tube 1 metre long and 6 cm diam. with plugs	0. 2. 3
55246. Tyndall's (Bromeis) Geyser Demonstration Apparatus , Figure, (Tyndall, "Heat", 4th Edn, 1894, Fig. 54), for heating by gas, Description The apparatus is heated by placing a bunsen burner and the gas-ring burner underneath, and gives an ejection of steam nearly every minute.	2 16. 0
55252. Sectional Model of a Steam Engine Cylinder , Figure, with flywheel . This model is entirely of metal. Bore of cylinder = 36 mm, length = 80 mm	2 2. 0
55253. — idem, Figure, with governor and throttle valve	4. 4. 0

Cl. 6311, 6313, 6260,
6708,
6845, 6913, 4206.

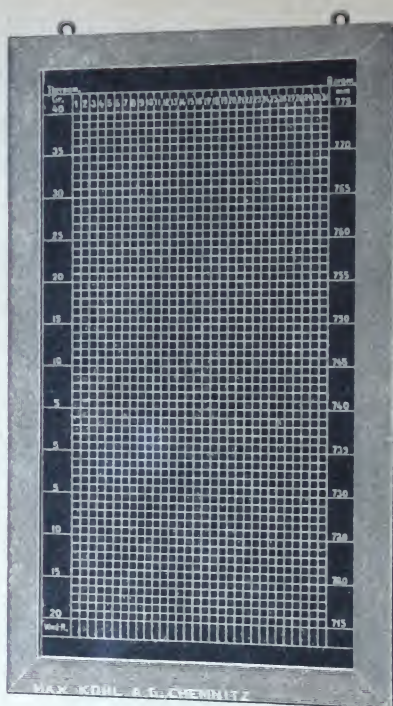


Propagation of Heat; Radiometers.

	£	s	d.
55 306. Davy's Safety Lamp (M. P., Fig. 457 [II., 2, Fig. 295]), Figure	0.	8.	0
83 142. Melting Vessel , Figure, with thermometer (N., Auf., Fig. 24), Aufg. 52, Ztschr. f. phys. u. chem. U., 15, p. 198, for determining the melting and solidifying point of a substance which shows retarded cooling (sodium persulphate or acetate)	0.	4.	0
83 143. Black Radiation Vessel , Figure, with thermometer, (Aufg. 54), for proving thermal radiation	0.	4.	0
55 397. Steam Capsule after Weinhold, for radiation experiments , Figure (W. D., Fig. 369 [349]), on stand. Description	0.	12.	0
55 400. Thermal Radiation Apparatus after Dulong and Petit, comprising a mercury thermometer with large thermometer cistern, and with holder and screens, Figure, Description	2.	8.	0
The thermometer is heated to a certain temperature, and the time measured which elapses until the thermometer has cooled down to the surrounding temperature. The experiment is repeated after the thermometer cistern has been coated with lamp black, gold-leaf, silver-leaf or with various dyes.			
55 406. Radiometer after Crookes, ordinary form, Figure	0.	5.	0



55 477. 1:14.



83 145. 1:12.

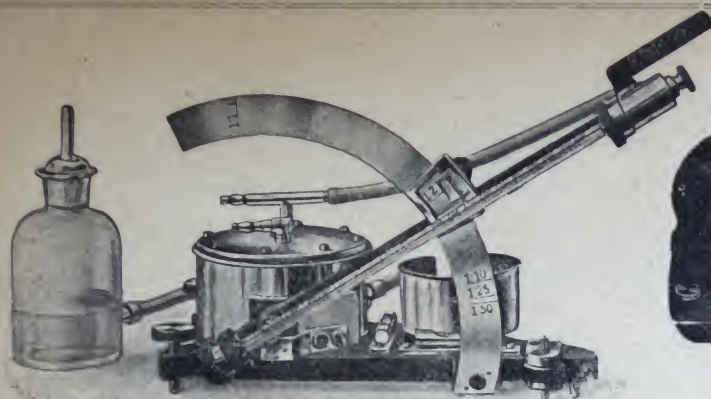


83 146. 1:8.

Meteorological Apparatus.

55 438. Actinometer after Violle, Figure on p. 1493, for measuring the energy of radiation of the sun	£ s. d. 31. 10. 0
83 144. Hygrometer after Noack, Figure, p. 1493, with thermometer (Exercise, Fig 30), Exercise 60, for determining the dew-point	0. 12. 6
55 460. Psychrometer , simple pattern, Figure, p. 1493, with larger water-tank and two thermometers graduated in $\frac{1}{2}^{\circ}$ C, with table	0. 10. 0
55 473. Rain Gauge after Prof. Hellmann, Figure, p. 1493, on tripod stand, for a catchment area of 100 sq. metres. The measuring glass gives the rainfall in millimetres	0. 9. 0
55 477. Anemometer after Wild, Figure, with intensity-scale. By means of a wind-vane connected to the anemometer, the plate is always set perpendicular to the direction of the wind, and the rise of the plate indicates the wind's velocity	3. 0. 0
83 145. Meteorological Blackboard , for recording the daily barometer and thermometer readings and the direction of the wind at definite hours of the day for a month, Figure	4. 0. 0
83 146. Apparatus for Recording the Diurnal Motion of the Sun , after P. Luckey, Figure (Ztschr. f. d. phys. u. chem. U., 1915, p. 151), Description	1. 12. 0

In the centre of a circular wood slab, covered by a hemispherical glass globe open at the top, a steel needle is fixed at its lower end so that it can set in any direction. To this end, the needle is enabled to turn about its horizontal axis by means of a hinge, and about its vertical axis by mean of a cylindrical joint. At definite and equal intervals of time, the needle is set in the direction of the sun's rays, i. e., it is set so that it casts no shadow on the white screen fixed at its base immediately above the point of rotation. This adjustment can be made without removing the glass globe by operating through a hole whose angle of aperture, however, is so small that even the sun at its highest altitude in our latitude falls on the glass. The location of the sun is marked by a grease-spot on the globe.



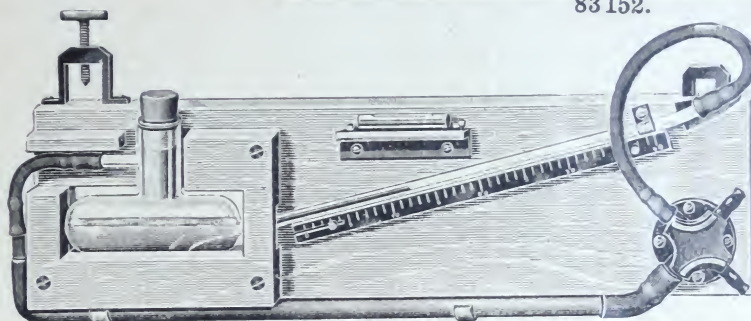
83147.



83151.



83152.



83154.

Micro-Manometers.

- | | £ | s. | d. |
|--|-----|-----|----|
| 83147. Micro-Manometer , Figure (Dr. Berlowitz's system) | 11. | 15. | 0 |
| With constant zero to the pivoting measuring tube, with graduated arc for setting to the ratios of transmission 1:50, 1:25, 1:10, 1:5, 1:2 and 1:1, with cross levels, rubber tube unions, filling bottle, including pipette, in lock-up carrying case. | | | |
| 83148. — idem. with a second longitudinal level on the pivoting arm for setting to the ratios 1:200 or 1:100 | 12. | 10. | 0 |
| 83149. — idem. for absolute pressures to 10 atmospheres and for use with mercury as the sealing liquid | 13. | 10. | 0 |
| 83150. — idem, light, handy type, with flat vessel | 11. | 15. | 0 |
| 83151. Micro-Manometer , Figure, as suggested by Krell | 5. | 10. | 0 |
| With fixed measuring tube, cross levels, compensated velocity sliding scale, stand, and filling funnel, specially suitable for use on switchboards for ventilating plants. Ratios: 1:200, 1:100, 1:50, 1:25, 1:10, 1:5, 1:4, 1:2 corresponding to ranges of about 4, 5, 7, 10, 16, 22 and 35 metres per second velocity. | | | |
| 83152. Micro-Manometer , Figure, with two fixed measuring tubes, after Dr. Rosenmüller | 8. | 0. | 0 |
| The two ranges overlap and can be suitably combined, as in following examples:
1:100 with 1:25, 1:10, 1:5. 1:25 with 1:10, 1:5, 1:4, 1:2.
1:50 with 1:10, 1:5, 1:4. 1:10 with 1:5, 1:4, 1:2.
Equipment as per List No. 83151. | | | |
| 83153. Carrying Case for Micro-manometers List Nos. 83151 and 83152 . . . | 1. | 4. | 0 |
| 83154. Pressure Recorder , Figure, mounted on wood board | 2. | 12. | 0 |
| With cock-body, pressure and velocity scale; range: 7, 15 and 30 mm water-column. Suitable for use as a boiler draught recorder. | | | |
| 83155. Stand Manometer , Figure, for larger differences of pressure, designed as a single limb manometer | 5. | 10. | 0 |
| Millimetre graduation on the measuring tube, with folding handle for transport purposes; for velocities up to 80 metres per second. | | | |
| 83156. — idem, for absolute pressures, to 10 atm. and pressure differences to 800 mm mercury; with metal measuring rod for any three scale-divisions | 6. | 0. | 0 |
| 83157. Carrying Case for stand manometer | 1. | 2. | 0 |
| 83158. Micro-Manometer Cock , for measuring static pressure, greater or smaller than barometer pressure, also for measuring velocity, and setting to zero | 2. | 14. | 0 |

C1 7467, 7469,
7468, 7470,
7464.



83155.

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